CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

FEBRUARY 15, 1943

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

Foreman checks hardening temperature by glance at the furnace's Micromax Controller.

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4. Other problems will appear, due to the many differences in weight and bulk, in heating and cooling speeds, in transformation points, etc., between metals and ceramic materials. In some ways, metals are easier to heat than ceramics; in some ways harder. But the men and furnaces of the ceramic industry can do and are doing heat-treatment with great success, and we are proud to be helping them. If you have a problem, perhaps we can help you.

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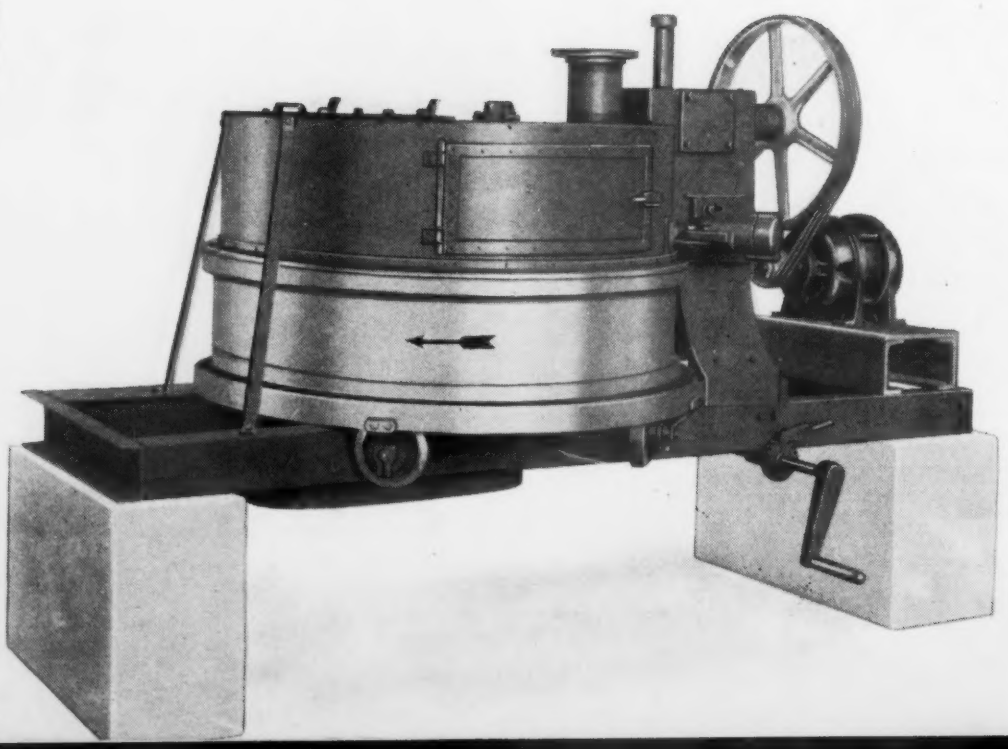

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You cannot help men permanently by doing for them what they could and should do for themselves."

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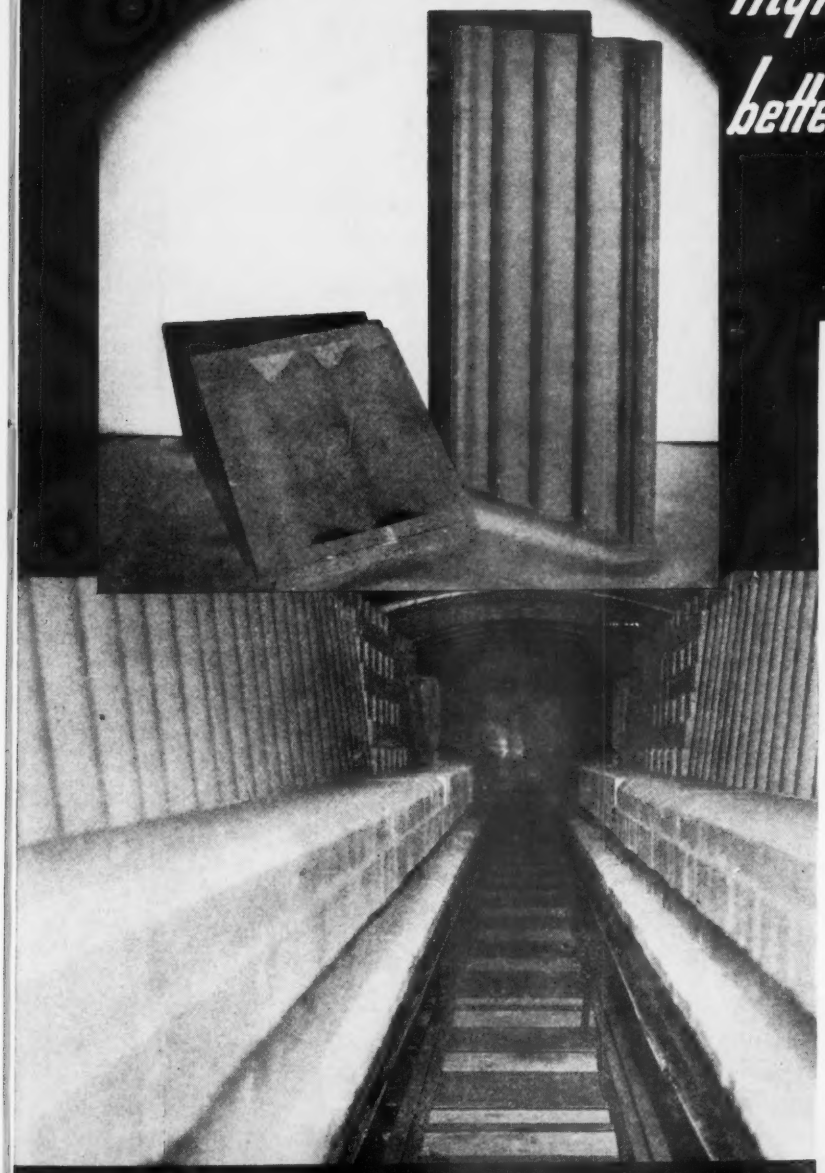

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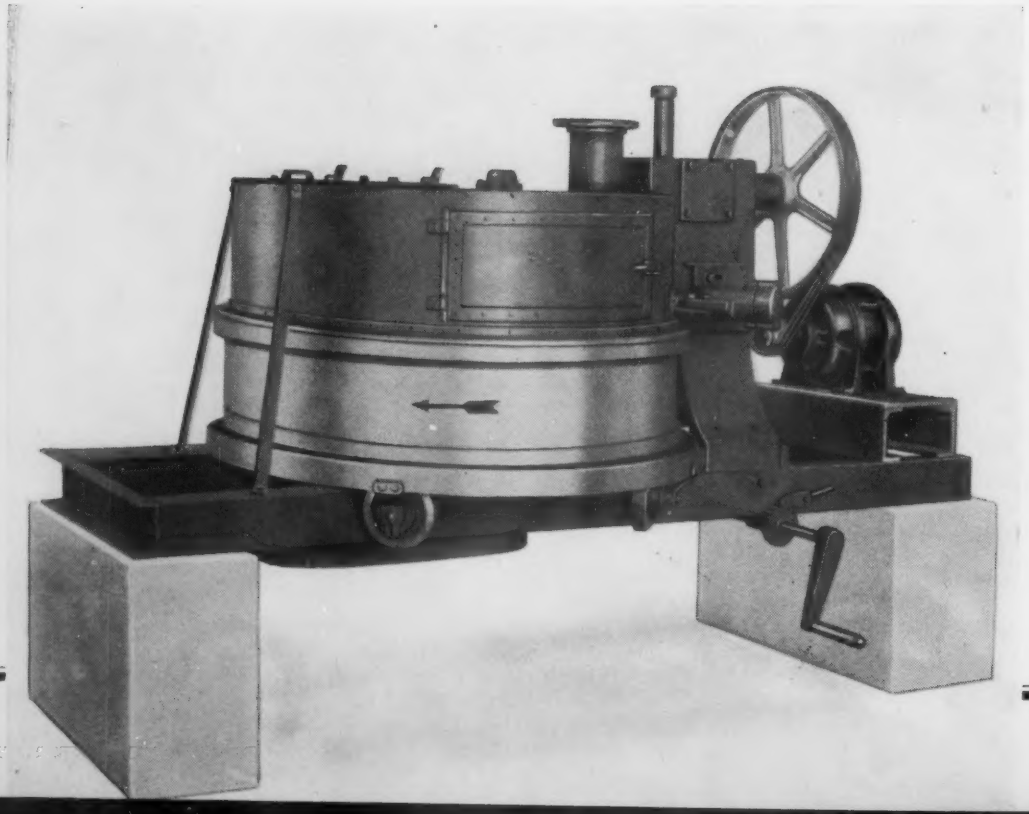

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JOURNAL REFERENCE: The journal name appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 22 **February 15, 1943** **No. 2**

Abrasives

Jig grinder for dies and jigs. ANON. *Can. Machinery*, **53** [8] 108 (1942).—The ever-increasing accuracy demanded in sheet-metal stampings has created the problem of grinding holes, both straight and tapered to size and location. This has been accomplished by various makeshift methods, but a machine is described which requires less skill and gives greater accuracy and fewer mistakes. E.D.M.

Wickman form grinder. ANON. *Machinery* [N. Y.], **48** [11] 236 (1942).—The Optical Form Grinder is designed for accurate finish grinding of flat or circular form tools, punches and dies, profile gauges, templates, etc. It is particularly adaptable for grinding parts made of tungsten carbide and hard tool steels. R.H.B.

BOOKLET

Grinding Cutter Bits. Published by South Bend Lathe Works, South Bend, Ind. Booklet No. 35, 12 pp. Price 10¢; free to shop superintendents and apprentice supervisors. Reviewed in *Can. Machinery*, **53** [8] 156 (1942).—The identification and application of various cutter bits, methods of grinding, and correct angles for grinding are discussed. E.D.M.

PATENTS

Abrasive wheel. B. H. WORK AND D. S. KLAUDER, JR. (Carborundum Co.). U. S. 2,304,226, Dec. 8, 1942 (March 1, 1941).

Chuck and grinding wheel. C. E. HITE (L. J. Musser). U. S. 2,304,173, Dec. 8, 1942 (May 23, 1940).

Coated abrasive. E. G. HAM (Behr-Manning Corp.). U. S. 2,305,157, Dec. 15, 1942 (July 17, 1936).

Design for grinding machine. C. H. ANTRIM (Hammond Machinery Builders, Inc.). U. S. 134,699, Dec. 29, 1942 (Oct. 26, 1942).

Drill-grinding gauge. B. S. STANFIELD. U. S. 2,306,762, Dec. 29, 1942 (Nov. 18, 1941).

Grinding machine. CHARLES HERFURTH AND R. D. WORTENDYKE (Cincinnati Grinders, Inc.). U. S. 2,303,639, Dec. 1, 1942 (Dec. 30, 1940); divided out of U. S. 2,254,010, Aug. 26, 1941 (April 25, 1938). J. M. LUERS (John Milton Luers Patents, Inc.). U. S. 2,304,580, Dec. 8, 1942 (Feb. 21, 1942). ALFRED RICKENMANN (Reishauer-Werkzeuge Akt.-Ges.). U. S. 2,305,390, Dec. 15, 1942 (Aug. 13, 1941).

Grinding wheel truing apparatus. C. C. ALVORD AND C. G. FLYGARE (Norton Co.). U. S. 2,303,715, Dec. 1, 1942 (Feb. 12, 1941).

Licker grinder. J. F. LEHMAN (Felton Wimberly, Jr.). U. S. 2,304,647, Dec. 8, 1942 (April 12, 1941).

Machine for grinding blade surfaces of screw propellers. I. D. EBY. U. S. 2,303,529, Dec. 1, 1942 (July 13, 1940).

Normal dresser for grinding wheels. ALBERT TURNER (Fellows Gear Shaper Co.). U. S. 2,304,970, Dec. 15, 1942 (May 22, 1941).

Polishing, grinding, or like machines for treating wire, rods, etc. S. R. HOWES AND S. FOX & CO., LTD. Brit. 549,094, Nov. 18, 1942 (Jan. 8, 1942); addition to Brit. 484,923, May 25, 1938 (Nov. 13, 1936).

Polymerizing unsaturated methylene compounds. NORTON GRINDING WHEEL CO., LTD. Brit. 549,234, Nov. 25, 1942 (Oct. 6, 1939).

Positive retraction honing tool. J. B. KLEIN (Micromatic Hone Corp.). U. S. 2,304,930, Dec. 15, 1942 (April 1, 1938).

Precision grinding machines. CHURCHILL MACHINE TOOL CO., LTD., AND H. H. ASBRIDGE. Brit. 549,137, Nov. 18, 1942 (Sept. 12, 1941).

Surface-grinding fixture. W. F. HINDERER. U. S. 2,303,459, Dec. 1, 1942 (Aug. 2, 1941).

Surface-grinding machines. T. STOPPARD. Brit. 549,071, Nov. 18, 1942 (Dec. 12, 1941).

Tool grinder. C. E. ALLEN. U. S. 2,305,230, Dec. 15, 1942 (Jan. 3, 1942).

Wheel dresser and method of dressing grinding wheels. JOHN SNEED. U. S. 2,305,115, Dec. 15, 1942 (March 9, 1939).

Art and Archeology

American war standard specification and description of color. ANON. *Jour. Optical Soc. Amer.*, **32**, 694–96 (1942).—To recognize and recommend a basic method for the specification of color and to facilitate its popular interpretation: (1) the spectrophotometer is taken as the basic instrument; (2) technical color specifications are computed by the 1931 International Commission on Illumination method; (3) material standards may be used to interpret these specifications in familiar terms (the 1929 Munsell Book of Color has been correlated with the basic specifications and bridges the gap between the aesthetic and the scientific comprehensions of color); (4) a correlated system of color names adapted from common language has been defined in terms of the Munsell system and provides a literary method for the description of color wherever general comprehensibility is desired and precision is not important. A.P.

Eras and nationalities as reflected in the mirror of handicrafts. J. GR. *Keram. Rundschau*, **46** [26] 289–93 (1938).—Exhibits of twenty-five nations at the International Exposition of Handicrafts, Berlin (1938), gave a good idea of the folk art and culture of the countries represented. Some of the exhibits are described briefly. Illustrated. M.V.C.

German handicrafts from southeastern Europe. GR. *Keram. Rundschau*, **46** [12] 131–32 (1938).—Ceramics and glassware showing German traits from countries neighboring Germany were exhibited at the Berlin Exposition of modern and antique handicrafts. M.V.C.

Mildred Davis Keyser. ANON. *Bull. Amer. Ceram. Soc.*, **22** [1] 1–5 (1943).—5 photographs.

Stoneware ceramics. Works of Paul Dresler. HEINZ EMRICH-DORMANN. *Keram. Rundschau*, **46** [18] 201–203 (1938).—The development of the creative talent and the fine sense of form of this master of ceramic art is described. Illustrated. M.V.C.

Technical and art porcelain. Thuringer Exposition. ANON. *Keram. Rundschau*, **46** [24] 265–68 (1938).—Household, art, and technical articles produced from Thuringer porcelain are described. See "Old Thuringian. . . ," *Ceram. Abs.*, **21** [8] 163 (1942). M.V.C.

PATENTS

Decalcomania transferring machine. I. C. ORSWELL. U. S. 2,305,553, Dec. 15, 1942 (May 6, 1940).

Designs for:

Cookie jar. R. V. GANZ (Shawnee Pottery Co.). U. S. 134,511 to U. S. 134,514, Dec. 8, 1942 (Oct. 9, 1942).
Mug. CARL ROMANELLI (Metlox Mfg. Co.). U. S. 134,616, Dec. 22, 1942 (May 1, 1942).
Oyster dish. J. M. FENTON. U. S. 134,659, Dec. 29, 1942 (Oct. 30, 1942).
Saucer. ALBERT TUJAGUE (Loubat Glassware & Cork Co.). U. S. 134,565, Dec. 15, 1942 (July 22, 1941); divided out of U. S. 129,496, Sept. 16, 1941 (April 26, 1941).
Stove. EDWIN ESSON (Locke Stove Co.). U. S. 134,700, Dec. 29, 1942 (Oct. 28, 1942).

Cements

Manufacture of plaster molds. G. *Keram. Rundschau*, **46** [18] 205–206 (1938).—Plaster molds are more economical than wood molds for many purposes, providing they are made carefully according to the directions given by G. See "Pottery . . .," *Ceram. Abs.*, **19** [10] 230 (1940). M.V.C.

Nature and liming value of quenched calcium silicate slag. W. H. MACINTIRE, L. J. HARDIN, S. H. WINTERBERG, AND J. W. HAMMOND. *Soil Science*, **50** [3] 219–37 (1940).—Basic open-hearth furnace slags are discussed, and measurements of their rate of solution in distilled water and carbonated water are reported. Toxic effects of the P_2O_5 content on plant growth were found in some cases where the slag was added to soil in too large amounts or with too fine a particle size. 20 references, 12 figures. V.D.F.

Enamel

Adherence of glass to metals. R. M. KING. *Glass Ind.*, **23** [11] 421–23, 440 (1942).—Weyl has suggested much for thought and experiment regarding glass-to-metal adherence through "oxygen bonds" (see "Replacement . . . ," *Ceram. Abs.*, **21** [10] 211 (1942)). Several of his statements require confirmation by references or by experiment. (1) What is the true coordination of cobalt in glass? (2) Is fourfold-coordination cobalt responsible for adherence? (3) How may the oxide theory of adherence be extended to overcome its present inadequacies? Seven glasses containing cobalt (0.8 Co_3O_4) were tested for adherence in relation to hot and cold colors, and no correlation with pink or blue was observed. The dendrite theory is supported by evidence which has not been contradicted, and while the action of the system cobalt enamel and steel seems to be specific, "oxygen bonds" and "residual valences" must play a secondary role. A.P.

Cast-iron porcelain enameling. A. BIDDULPH. *Enamelist*, **19** [12] 14–17, 48 (1942).—Blistering of cast-iron enamels and its causes are discussed. This defect is due mostly to the evolution of gases (CO, CO_2, and H_2) near the firing temperature of enamels. The design of the cast-iron parts, i.e., great variations in cross section, also plays a part in blistering (microchill). *Ibid.*, **20** [1] 7–11 (1942).—The use of a good-quality metallic abrasive in place of the dust-producing silica grain for cleaning castings for enameling is described. The abrasive consists of chilled-iron grit. The old iron nozzles have been replaced with long-lived Carboloy or boron nitride nozzles. Air supply and nozzle manipulation are described. L.E.T.

Continuous enameling furnace. ANON. *Gas World [Ind. Gas Supp.]*, **9** [3] 12, 18 (1937).—A continuous enameling furnace designed by the Ferro Enamel Corp. and built at Luton, England, began production in 1937. L.R.B.

Conversion of vitreous enamel muffle furnace from coal firing to town gas. ANON. *Gas World [Ind. Gas Supp.]*, **9** [7] 11, 18 (1937).—A plant engaged in re-enameling used gas cookers converted a producer gas fired muffle furnace to town-gas firing by leading town gas into the original portholes; 1500 cu. ft. of gas (approx. $CV = 500$) is used for each cooker, the cost of the gas alone being 2s 3d. With producer-gas firing, the cost was 1s 3d for coal alone. The increased cost of fuel was compensated by the increased cleanliness and the elimination of labor for cleaning out ashes and flues. A brief account is given of the enameling operations. L.R.B.

***Enamelist* contest on "what the war will bring to postwar porcelain finishing."** *Enamelist*, **19** [10] 8–9; [11] 8–10 (1942).—Comments in the form of letters by leaders in the enameling field are presented. The prize letters deal with various problems, such as chemical control, plant construction, improved enamels, personnel training, steel fabrication, and general modernization ideas for postwar operations. L.E.T.

Gas-fired furnaces for vitreous enameling. ANON. *Gas World [Ind. Gas Supp.]*, **9** [9] 17 (1937).—Equiradiant town gas fired enameling furnaces are included in the new equipment installed by the Wandsworth (London) Gas Co. L.R.B.

Gouge resistance of porcelain enamels. G. H. SPENCER-STRONG AND W. G. COOPER. *Jour. Amer. Ceram. Soc.*, **26** [1] 1–4 (1943).

Method for cleaning steel pipe. ANON. *Enamelist*, **19** [10] 12–13 (1942).—Methods and equipment for removing heavy heat-treat scale from seamless steel tubular pipes are described. 2 photos. L.E.T.

Nature and causes of small color differences in industry. Lighting for their detection. A. H. TAYLOR. *Jour. Optical Soc. Amer.*, **32**, 651–58 (1942).—Many types of color differences occur in quantity production, and allowable color tolerances often require accurate control and rigid inspection. Factors producing small color differences common to various dissimilar materials include thickness of the material and character of the background. Spectral transmittance and reflectance curves are analyzed to illustrate and explain these factors. Porcelain enamels are sensitive to thickness and to refiring because of the dark background. Viewing should take place under three light sources: (1) natural or artificial daylight, (2) a filament lamp at normal or below-normal voltage, and (3) an illuminant rich in near ultraviolet. Small differences are most definitely revealed by an illuminant radiating throughout the visible spectrum but especially rich where the colored object has maximum absorption. Where articles on the production line vary through a wide color range, daylight is best if a single illuminant is to be used. Color-matching booths should provide at least two sources differing widely in spectral energy distribution. Fluorescent lamps make available color temperatures of 3500, 6500, 8500, and 11,000°K. A.P.

Porcelain enamel equipment: care and storage for the duration. C. D. PARKHILL AND G. L. JOHNSON. *Enamelist*, **19** [12] 8–9 (1942).—Suggestions are made on the storing of enameling equipment not used for the duration of the war. This includes a general cleaning-up in the mill room, pickle room, and furnace department. Spraying and drying equipment must be protected and packed to prevent corrosion, ball mills must be cleaned, and temperature-control equipment should be properly stored. L.E.T.

Preparation, drying, and firing of enamels and glazes. ANON. *Gas Jour.*, **231**, 407–11 (1940).—A review is given, including some detailed accounts with drawings of frit furnaces, spray evaporators, and continuous furnace layouts to prevent dust entry. L.R.B.

Short course in heat-treating for porcelain enamelers. ROBERT W. FORAKER. *Enamelist*, **20** [2] 5–9 (1942).—A course sponsored by the Forum Committee of the Porcelain Enamel Inst. was held Nov. 2–6, 1942, at the University of Illinois. The allotropic changes of iron, the quenching of iron, and the cause of cracks appearing in the metal due to improper treatment were discussed. Hardness tests and impact tests were demonstrated, and equipment for the control of furnace atmospheres was exhibited. L.E.T.

PATENTS

Bathtub. H. G. COORDES (Briggs Mfg. Co.). U. S. 2,305,846, Dec. 22, 1942 (Aug. 15, 1940).

Making laundry tubs, etc. V. J. GRAF (Briggs Mfg. Co.). U. S. 2,305,866, Dec. 22, 1942 (Sept. 5, 1939).

Making white clouded enamel. IGNAZ KREIDL (vested in Alien Property Custodian). U. S. 2,305,313, Dec. 15, 1942 (Aug. 21, 1936).—In a method of producing a gas-clouded vitreous enamel, the step of incorporating in the enamel batch an organic gas clouding agent and a compound containing antimony and oxygen in an amount less than 1% of the enamel to remove discoloration caused by the residue resulting from the decomposition of the gas clouding agent.

Manufacture of opaquing agents. C. J. HARBERT AND L. A. BATEMAN (Harshaw Chemical Co.). U. S. 2,306,356, Dec. 22, 1942 (Sept. 16, 1940).—A process of preparing an opaquing agent for vitreous enamels comprising heating in an oxidizing atmosphere a batch containing in approximately the indicated proportions the following:

		Molecular weight
Sb_2O_3		1
TiO_2		2.75–3.25
$Ca(OH)_2$ 10 to 50% $CaCO_3$ 50 to 90%	To yield CaO	2–3

Opaquing agent for vitreous enamels. C. J. HARBERT AND C. A. SEABRIGHT (Harshaw Chemical Co.). U. S. 2,306,357, Dec. 22, 1942 (Sept. 26, 1940).—A new composition of matter suitable for use as an opaquing agent, the same being the product of calcining under oxidizing conditions materials capable of yielding (in molecular weight) Sb_2O_5 1, TiO_2 1 to $4\frac{1}{2}$, and CaO between 3 and $4\frac{1}{2}$.

Production of glass coatings on objects of materials having high melting points. PHILIPS LAMPS, LTD. (N. V. Philips' Gloeilampenfabrieken). Brit. 549,277, Nov. 25, 1942 (Nov. 17, 1941).

Glass

Basic principles involved in the glassy state. B. E. WARREN. *Jour. Applied Physics*, **13** [10] 602–10 (1942).—Glass can be classed as one branch of the group of amorphous solids. It does not follow that any amorphous solid is a glass. Distinction must be made between the terms "glass" and "glassy state." The primary conditions for glassforming ability are (1) random bonding, (2) energy of the random structure not much greater than that of the crystalline solid, and (3) a flexible scheme of bonding. The present picture of the atomic arrangement in glass has developed from (1) the laws of crystal chemistry, (2) X-ray diffraction studies, (3) physical-property data, and (4) the kinds of materials and composition ranges in which glassforming properties exist. Disorder in vitreous silica leads to its abnormally small thermal-expansion coefficient, increased compressibility with pressure, and decreasing electric breakdown strength with increasing temperature. Atomic arrangement and rough free energy treatments give insight into immiscibility in the lime–silica system and into the boric oxide anomaly. Structure and glassforming properties depend upon the ratio of oxygen to network cations. The glassy state offers an interesting field for study, because many of the properties can be changed continuously and high temperature states can be frozen-in. So far the picture is only a first-order approximation, and facts such as the conditioning of glass at various temperatures will require the refinements of the next order. X-ray diffraction cannot contribute much more, but information will be derived from a variety of techniques: physical-property studies, Raman and infrared spectra, dielectric constants, and color indicators. A.P.

Bubble glass. K. M. SWEZEY. *Popular Science*, **141** [5] 49–51 (1942).—Pittsburgh Corning Corp.'s Foamglas in blocks 12 x 18 in. and four thicknesses, 2 to 6 in., has the following characteristics: 5 million air cells per cu. in., a density of 10 to 11 lb. per cu. ft., stability up to 1000°F., and half the insulating value of cork, compensated by a crushing strength of 150 lb. per sq. in. Foamglas can be sawed, drilled, and shaped with ordinary carpenter's tools and used as a wall by cementing with hot asphalt. Illustrated. See "Glass goes to war," *Bull. Amer. Ceram. Soc.*, **21** [8] 161–62 (1942). A.P.

Calculation of density and optical constants of a glass from its composition in weight percentage. MAURICE L. HUGGINS AND KUAN-HAN SUN. *Jour. Amer. Ceram. Soc.*, **26** [1] 4–11 (1943).—4 references.

Development of low-melting glasses on the basis of structural considerations: I–IV. N. J. KREIDL AND

W. A. WEYL. *Glass Ind.*, **23** [9] 335–38, 357; [10] 384–86, 402–403; [11] 426–28, 441; [12] 465–67, 480 (1942).—Meltability is selected to demonstrate how B. E. Warren's interpretation of glass structure can be practically applied to develop glasses with new properties. Certain approximations can be used even where actual structures of multicomponent glasses cannot be established. In such cases the oxygen ratio is a useful concept. In most commercial soda-lime glasses, the ratio of oxygen to silicon is between 2 and 2.5. The tendency to devitrify increases with higher ratios, until, at a ratio of 4, glass formation is impossible. Because phosphorus has a valence of five, a phosphate glass of approximately the same meltability as a silicate glass contains less alkali. Other structural changes also contribute to the meltability, as other elements can substitute for (1) the oxygen, (2) the network formers (Si^{4+}, P^{5+}), or (3) the network modifiers (Na^{+}, Ca^{++}). Many elements which are not in themselves network formers can form a part of the network. Structural changes leading to a lower-melting glass are discussed: (1) the introduction of BO_3 triangles instead of SiO_4; (2) increase of the oxygen ratio; (3) partial replacement of the network former by one of larger size or of lower valency, the oxygen ratio being maintained; (4) replacement of a modifier by one of a higher potential (Na→Li) or by a variety of modifiers; (5) replacement of oxygen by monovalent ions. Practically, the extent to which these structural changes can be utilized is limited by (*a*) devitrification, (*b*) immiscibility, (*c*) volatility, and (*d*) chemical instability. Successful low-melting glasses would be impossible if the chemical resistivity and the structural strength were completely parallel, but the influence of composition on resistivity is too complicated to permit correlation with simplified structural principles alone. Methods used by historical and contemporary glassmakers to melt their glasses at lower temperatures are correlated with the five structural principles under the following headings: (1) Alkali, (2) Soda-lime glasses, (3) Fluorine glasses, (4) Lead glasses, (5) Bohemian crystal, (6) Thuringian (alumosilicate) glasses, (7) Jena resistant glasses, Pyrex brand glass, (8) Basis of enamels and vitrifiable colors, and (9) Low-melting phosphate glasses. A.P.

Dispersion of silicate glasses as a function of composition: II. M. L. HUGGINS, K.-H. SUN, AND D. O. DAVIS. *Jour. Optical Soc. Amer.*, **32**, 635–50 (1942).—An equation previously proposed by Huggins for refraction and dispersion (*Ceram. Abs.*, **20** [4] 88 (1941)) contained two empirical constants per component oxide. It is improved by the addition for each component of a term containing a single new constant which is the same for all components and is required by the infrared absorption band. At large percentages, PbO, CaO, and BaO need another term containing two additional characteristic constants. Extended and revised values for characteristic refraction and dispersion constants have been computed to fit the new equation and are collected in a table. The values for Al_2O_3 are inconsistent because of inadequate data. Tests of the new equation and data show outstanding agreement in the visible range. A.P.

Effect of explosions on window glass. F. W. ADAMS. *Crucible*, **27**, 212 (1942).—Experiments were made concerning the effect of explosions of dynamite and TNT on window glass. The explosive was 8 to 80 ft. from the glass, and the explosions were the equivalent of a 150-lb. bomb landing 43 to 2220 ft. from the window. Glazing materials tested were plate glass, laminated glass, tempered glass, wire glass, and transparent plastics. Precautions should be taken with the idea of reducing large, sharp, barbed fragments with high kinetic energy to smaller and less harmful pieces. Chicken-wire screening applied close to the inside of the glass should have a mesh of $^1/_2$ in. or less. The best protective coating was cheesecloth plastered on the glass with ordinary flour paste. Laminated glass needs no protection. Tempered glass bends, but when heavy charges are used it breaks and forms $^1/_4$-in. cubes which do not scatter much. Opening of windows had little effect on the breaking of the glass. In case of bombing, one should keep as far away from windows as possible. See "Testing . . .," *Ceram. Abs.*, **21** [8] 169 (1942); "Glass . . .," *ibid.*, [9] 186; "Adhesion . . ., *ibid.*, [11] 230. W.D.F.

Effect of grain size of raw materials on the smelting properties of glass. T. H. *Keram. Rundschau*, **46** [25] 281–82 (1938).—The degree of fineness of mineral raw materials has a definite effect on the quality of the glass. H. describes a series of experiments made to establish criteria with regard to the optimum fineness for sand, dolomite, and lime. The results of experiments with grain sizes of 0.1 to 0.3, 0.3 to 0.5, 0.5 to 1.0, and above 1.0 mm. are tabulated and show that not all raw materials should have the same grain size. Coarse sand makes smelting more difficult, and fine sand has an unfavorable effect on refining; finely ground lime makes the glass seedy; coarse dolomite is hard to melt and leaves bubbles. In most cases a medium grain size is best, but other factors such as batch composition, smelting conditions, and kinds of raw materials must be taken into account if satisfactory glass is to be produced. M.V.C.

Glass-beaded paint for blackout traffic control. R. A. MITCHELL. *Eng. News-Record*, **129** [21] 720–21 (1942).—White paint surfaced with glass beads has been found superior to all other types of painted pavement marking in Philadelphia. Although glass-beaded paint costs more than twice as much as ordinary traffic paints, it wears four to five times as long. On vertical surfaces, glass-beaded cloth is used instead of paint. Illustrated. See "New developments . . . ," *Ceram. Abs.*, **21** [9] 187 (1942). G.A.K.

Glass fiberboard saves war metals. ANON. *Science News Letter*, **42** [18] 285 (1942).—The use of a glass fiberboard for heat insulation in fighting ships and auxiliary vessels has saved 5,500,000 lb. of aluminum and other lightweight metals in less than a year. G.A.K.

Glass fibers. ANON. *Science News Letter*, **42** [21] 334 (1942).—Glass fibers are being used as a covering for camouflage nets. They can be painted to blend with the surroundings, are light and fireproof, and cannot be destroyed by incendiary bombs. G.A.K.

Glass floats. ANON. *Science News Letter*, **42** [21] 334 (1942).—Glass floats for fish nets are being made to replace the cork, metal, or other floats previously used. The glass is thick and spherical, making it difficult to break. See *Ceram. Abs.*, **21** [9] 186 (1942). G.A.K.

Glass-pigment systems. C. ROBERTSON. *Jour. Applied Physics*, **13** [10] 635–38 (1942).—The physics of pigment systems in glass includes all the complex problems of ordinary pigment-vehicle systems plus other variables inherent in the use of high temperatures. So far most work has been trial and error, but some day it may be possible to compute the desired results from the basic optical properties of the particles and the matrix material. Glasses used as coatings comprise 99% of those pigmented. Glassy coatings are applied to three types of bases: clayware, metals, and massive glass. The glassy compositions used for each are distinguished by the melting-point limitations imposed by the temperatures which the base materials will withstand: clayware, up to 1400°C. and as low as 700°C. for special types; metals, 750° to 850°C. but up to 950°C. for acid-resisting chemical ware; glass, 500° to 600°C. Pigmenting of ordinary glass is infrequent because the pigment is destroyed during the long cycles at high temperatures. The only possible remedy would be the introduction of pigments at a late stage in the glassmaking operation. Glassy coatings are nearly all alkali-alkaline earth or lead silicates. A table illustrates typical melted weight-percentage compositions. Glasses used as coatings are formulated with respect to many properties and special requirements. Practically all of these coatings are pigmented, and from the viewpoint of physical optics there is no intrinsic difference between a pigmented glass layer and a pigmented paint-vehicle layer. Because of the heat and attack by molten glass, different pigment compositions are used for glasses than for paints. Typical compositions are tabulated. A pigment is a mixture of several types of colored compounds intimately admixed. Usually pigments

are formed by thermal reactions between the oxides at 1000° to 1400°C. for 1 to 8 hr. A.P.

Influence of light-weakening protective glasses on contrasts in brightness of different colors. H. HARTINGER. *Z. ophthalm. Optik*, **28** [5–6] 129–45 (1940); abstracted in *Physik. Ber.*, **22** [4] 483–84 (1941).—Two typical light-absorbing protective glasses (the neutral-gray Zeiss Umbral glass and the Neophane glass of the Auer Ges. which absorbs particularly in the yellow) were compared to determine their influence on the contrast in brightness of different colors. Both protective glasses had a total permeability of 24.8% for light with a color temperature of 2770°K. The tests were made with six Ostwald color circles, and the light intensity of two color samples with respect to each other was determined with and without the protective glasses. An increase in the brightness ratio by the protective glass indicates an increase in contrast; a decrease of the ratio shows a reduction in contrast. The Umbral glass was superior to the Neophane glass in every respect. While the Umbral glass showed an increase in contrast in 54% of all cases and a reduction in 39%, the Neophane glass gave only 26% increase but 66% decrease in contrast. In 7 and 8%, respectively, of all cases the contrast was not changed by the protective glass. The physiological factors in the evaluation of the results are discussed. M.Ha.

Influence of silica stones on strength of glass containers. W. R. LESTER. *Glass Ind.*, **23** [12] 461–62, 478 (1942).—Excessive breakage on a 12-oz. round packer container was traced to silica stones near the inside surfaces. The stones were composed of a mixture of large tridymite and small cristobalite crystals 1 mm. to 4 mm. in diameter. Impact tests broke all of 100 bottles containing stones near the inside surface and none of 100 with stones located on the outside surface. Thermal-shock and internal-pressure tests showed no differences, the breaks not arising from the stones. The weakness on impact caused by internal surface stones seems similar to the internal scratching phenomena. A.P.

Mechanical properties of glass. F. W. PRESTON. *Jour. Applied Physics*, **13** [10] 623–34 (1942).—Glass is the best material available for studying the mechanical properties of matter, because it avoids the complications that metals, wood, etc., introduce. Excessive brittleness distinguishes glass from most other materials, the fundamental physical factors involving the simultaneous presence of high elasticity and fair to high tensile strength and a complete absence of plasticity. Glass challenges comparison with ordinary metals of construction but not with wood, rubber, or plastics. From the viewpoint of the physical chemist, glass is an undercooled liquid, but this does not mean that glass is a liquid, and the phrase has led to much misinterpretation of the flow and viscosity of glass at ordinary temperatures. Viscosities of the order of 10^{70} poises are unrealizable and meaningless, and a limit should be set at about 10^{14} or 10^{17} poises. Jeffreys has said that vitreous silica is the most perfect elastic substance, the most typical solid. Theoretically glass should stretch to double its length before it breaks at a stress of several million pounds per square inch, but the "strength of glass" is an elusive quantity, and it is not safe to figure on a strength of more than 3000 lb. per sq. in. under continuous loading and normal conditions. A curve gives the fatigue of glass and porcelain under steady loads for durations ranging from $^1/_{100}$ sec. to 10^8 sec. (about 1 day). The theoretical equation of the curve remains unknown. Fatigue with metals refers to pulsating loads, but the plots are remarkably similar as are the physical behaviors of the materials. Data on variation in the strength of glass with temperature from 200° to 520°C. are also plotted in comparision with a corresponding curve for steel. Glass has a minimum strength at 200°C., whereas steel has a maximum in this region. Cracks in glass are as distinctive as fingerprints, leading to the subject of fracture diagnosis. The cracks are propagated at a speed of 5040 ft. per sec. in soda-lime glass and of 7220 ft. per sec. in fused silica. The temperature coefficient of the velocity is not known. Surface abrasions have an extraordinary weakening effect on the glass. Any ordinary piece of glass is likely to acquire surface abrasions, and ordinary strength tests are made upon glass which is already damaged. They really measure how nearly broken the glass is already. After etching with dilute HF, the strength increases ten or twenty times. The spontaneous decrease in strength of glass with time is not understood. The adsorbed moisture film also decreases the strength of glass and controls fatigue. A.P.

New annealing technique in optical glass produces greatest homogeneity. ANON. *Glass Ind.*, **23** [11] 424–25 (1942).—Seven pictures and their captions describe the new process of heat-treating optical glass developed by E. D. Tillyer of the American Optical Co. A.P.

Note in the development of a red stain on heat-resisting gas globes. W. M. HAMPTON. *Gas World*, **104** [2698] 374 (1936).—A reddish stain on heat-resisting glass globes used with high-pressure gas was traced to reduced copper fired into the glass. It can be reproduced by directing the green flame from the "burning back" Bunsen burner onto the glass or by strongly heating a thin film of copper sulfate on the glass. The source of the copper is ascribed to the fittings. L.R.B.

Problems relating to optical glass. W. M. HAMPTON. *Proc. Phys. Soc.* [London], **54** [305] 392–404 (1942).—Four main difficulties which face any manufacturer of optical glass under wartime conditions are listed: (1) the difficulties of supplying glass in sufficient quantity, (2) the difficulty of obtaining raw materials of the necessary quality, (3) the effect of heat-treatment on the optical properties of glass, and (4) the more general question of the durability of the glass. A Canadian-British Government-owned optical-glass plant is now operating in Canada. H. discusses the manufacture of slip-cast glass pots, the various problems involved in the production of optical glass, and various methods of testing glass. Illustrated. L.E.T.

Production of optical glass in Australia. E. J. HARTUNG. Reprinted in *Glass Ind.*, **23** [11] 429 (1942); see *Ceram. Abs.*, **21** [8] 168 (1942). A.P.

Silvered glass. ANON. *Science News Letter*, **42** [24] 383 (1942).—Silvered glass is replacing aluminum light reflectors formerly used for street lights, floodlights, and other equipment used in war production. G.A.K.

Toughened glass. ANON. *Science News Letter*, **42** [24] 383 (1942).—Toughened glass insulators for electrical transmission lines have been developed which will stand tensile loads up to 30,000 lb. G.A.K.

PATENTS

Apparatus for making sheet glass. L. B. WHITE AND F. S. THARP (Pittsburgh Plate Glass Co.). U. S. 2,303,805, Dec. 1, 1942 (March 24, 1939); refiled for abandoned application Serial No. 198,868, March 30, 1938.

Apparatus for the manufacture of mirrors. WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 2,306,318, Dec. 22, 1942 (Dec. 21, 1939).

Apparatus and method for charging molds with molten glass. ORIE SHACKELFORD. U. S. 2,305,739, Dec. 22, 1942 (May 9, 1939).

Apparatus for producing ground or polished continuous strips of glass. F. B. WALDRON AND J. H. GRIFFIN (Pilkington Bros., Ltd.). U. S. 2,304,974, Dec. 15, 1942 (Oct. 25, 1941).

Continuously producing glass having a plurality of layers. BERNHARD ENGELS (vested in the Alien Property Custodian). U. S. 2,305,683, Dec. 22, 1942 (July 18, 1938).

Glass-block assembly. G. M. RAPP (Pittsburgh Corning Corp.). U. S. 2,306,320, Dec. 22, 1942 (Oct. 10, 1940).

Glassblowing machine. J. P. BENOIT (Owens-Illinois Glass Co.). U. S. 2,304,727, Dec. 8, 1942 (Dec. 5, 1940).

Glass-fabricating machinery. S. A. FORTER AND H. H. SNYDER (Forter-Teichmann). U. S. 2,306,721, Dec. 29, 1942 (Sept. 29, 1941).

Glass heating and working. E. M. GUYER (Corning Glass Works). U. S. 2,306,054, Dec. 22, 1942 (Feb. 19, 1938).—(1) The method of working hard glass bodies which comprises introducing a current of electricity into a glass body from an external source spaced from the body

and simultaneously establishing relative motion between the body and the source. (6) The method of joining hard glass parts which comprises aligning the parts with their edges in spaced relationship, subjecting the edges and the glass adjacent thereto to radiant heating, passing a current of electricity through at least one of the edges to raise it to sealing temperature, and bringing the edges together to effect a seal.

Glassmelting-tank structure. W. W. OAKLEY (Corning Glass Works). U. S. 2,304,196, Dec. 8, 1942 (Dec. 26, 1940).

Glassware distributor for lehrs. R. A. SENKBEIL AND C. H. KNICKMAN (Maryland Glass Corp.). U. S. 2,304,379, Dec. 8, 1942 (July 9, 1941).

High-silica glass. M. E. NORDBERG AND H. E. RUMENAPP (Corning Glass Works). U. S. 2,303,756, Dec. 1, 1942 (Nov. 18, 1938).—A shaped article of glass containing silica, boric oxide, and alkali, the silica being over 93%, the boric oxide under 6%, and the alkali under 1%, the glass being vitreous and nonporous and containing also sufficient inorganic coloring material to produce coloration therein.

Making cellular glass blocks. E. H. HAUX (Pittsburgh Plate Glass Co.). U. S. 2,306,310, Dec. 22, 1942 (May 1, 1941).

Manufacture of laminated glass. ADOLF KÄMPFER (vested in the Alien Property Custodian). U. S. 2,305,827, Dec. 22, 1942 (April 23, 1936). M. D. LARDIN (Pittsburgh Plate Glass Co.). U. S. 2,306,314, Dec. 22, 1942 (Dec. 5, 1940).

Manufacture of vitreous insulating material. P. H. DEWEY (Pittsburgh Plate Glass Co.). U. S. 2,306,330, Dec. 22, 1942 (Sept. 21, 1940).—A process of manufacturing a foam of glass which comprises bubbling carbon monoxide through molten but viscous glass containing sulfates until a chemical reaction is induced as evidenced by the sudden liberation of many small bubbles distributed throughout the glass, then chilling the resultant foamy mass to entrap the bubbles therein, and annealing the product.

Manufacturing mineral-wool product. H. T. COSS, W. M. MACALPINE, AND H. V. SWINDELL (Johns-Manville Corp.). U. S. 2,305,516, Dec. 15, 1942 (May 29, 1940).

Method and apparatus for making fibrous glass products. GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,306,347, Dec. 22, 1942 (July 28, 1939).

Method and apparatus for making lenses. E. D. TILLYER (American Optical Co.). U. S. 2,304,217, Dec. 8, 1942 (Jan. 20, 1938).

Multiple glazed unit. J. J. SMITH (Pittsburgh Plate Glass Co.). U. S. 2,303,897, Dec. 1, 1942 (May 28, 1941).

Process and apparatus for tempering glass sheets. BERNARD LONG (American Securit Co.). U. S. 2,303,749, Dec. 1, 1942 (April 2, 1936).

Structural Clay Products

Brick arch replaces iron in bombed tunnel. ANON. *Eng. News-Record*, **129** [22] 739 (1942).—Reinforced brickwork was used to replace the upper half of the lining of a twin-tube electric-railway tunnel in Glasgow, Scotland. On the concrete backing were built two new arches of four-ring brickwork, laid in cement and reinforced by expanded metal placed between the second and third rings. G.A.K.

Brick thickness of "equivalent heat storage." F. BRUCKMAYER. *Gesundheits-Ing.*, **63** [6] 61–65 (1940); abstracted in *Physik. Ber.*, **22** [4] 382 (1941).—If the heat flow through brick walls does not remain constant, either heat is stored in the wall or the wall is cooled. B. developed a method for determining the amount of heat storage and for comparing the behavior of different walls. A diagram is developed by which the equivalent heat storage is given directly for any wall thickness. Examples are given. M.HA.

Hollow clay tile employed in a transportable hut. ANON. *Claycraft*, **16** [2] 57–59 (1942).—The newest standard design for huts by the Ministry of Works and Planning permits the use of brick or hollow tile for walls. The roofing members consist of hollow-tile beams of relatively small weight, as only narrow margins of reinforced concrete $2^1/_2$ in. deep occur at the sides of the 2-in. hollow tile. These roofing members are laid dry, with alternate interlocking edges to insure full load distribution. Mortar is used in the joints over the supporting frames. Wall members, which are set in recesses in the main posts, are 3-in. hollow-tile beams precast with reinforced-concrete margins and specially formed to give weather resistance. The floor consists of hollow-tile beams with reinforced-concrete margins laid dry between shaped precast reinforced-concrete sleepers. Although a large part of the structure consists of clay products, the whole can be readily dismantled and transported. G.A.K.

Mastic used to seal leaky brick walls. J. E. NICHOLSON. *Eng. News-Record*, **129** [21] 716–17 (1942).—N. describes a method used by the Pennsylvania Railroad to stop water leakage through a large brick exterior wall of a warehouse. The method comprised pointing up the joints, removing the spalling concrete, coating the walls with a gilsonite asphaltic mastic, and then covering the mastic with slate granules. Illustrated. G.A.K.

Structural tile barracks for the WAACS. ANON. *Eng. News-Record*, **129** [25] 838–40 (1942).—About 2,700,000 pieces of brick and tile were used for the first time in constructing a 112-building camp for the WAACS at a Midwest Army post. The buildings were completed in 60 days. They provide attractive and semipermanent quarters for 3150 women at a cost only 6% greater than that for all-wood construction. G.A.K.

Refractories

Alumina from domestic sources. ANON. *Mining Congr. Jour.*, **28** [10] 18–21 (1942).—Alumina produced in the U. S. at present is made from low-silica bauxite by the Bayer process. The next best raw material is high-silica bauxite. Such material is treated by the Bayer process, and the tailings or red mud is subjected to a lime-soda sintering operation; the sintered product is leached, and this liquid is added to the Bayer-process liquid. If no red mud were available, a considerable amount of clay could be used instead, but only in connection with a Bayer-process plant. A modified Pedersen process for the production of alumina from clay is the most promising process independent of the Bayer process. In this, the clay is sintered with lime and subsequently leached with soda; the details require considerable test-plant study. The best available acid processes are those using potash alum, e.g., the Kalunite process and others. As alumina abrasives need a special grade of low-silica bauxite, domestic bauxite of this grade should be reserved for this purpose. See *Ceram. Abs.*, **21** [3] 61 (1942). W.D.F.

Arc-furnace refractories. NORMAN F. DUFTY. *Iron & Steel*, **15** [8] 224–28 (1942).—D. lists the best choice of refractories for various parts of the furnace, considering cost, and gives a second choice in each case: roof, silica or aluminous firebrick; walls (above slag line), metal-cased magnesite or semistable dolomite; walls (below slag line), stabilized dolomite or magnesite; bottom, stabilized dolomite or magnesite; hearth, rammed dolomite (graded) or burned-in magnesite. Despite its limitations in a basic furnace, a good silica brick is better than a half-perished, semistable dolomite brick. E.H.McC.

Effect of temperature on high-alumina cement. F. M. LEA. *Jour. Soc. Chem. Ind.* [London], **59** [1] 18–21

(1940).—Parallel investigations of calcium monoaluminate and high-alumina cement revealed that both exhibit a decrease in set strength when cured at 45°C. compared with their strength when cured at 18°C. Studies of dehydration-temperature relations and density of hydration products at 18°, 45°, and 100°C. supported the hypothesis that the fall in strength is due to a transformation of the metastable less-basic hydrated calcium aluminates into the tricalcium aluminate hexahydrate. L.R.B.

Improved method for drying and preheating ladles. ANON. *Iron & Steel*, **15** [9] 272–73 (1942).—Lighting a fire in the ladle is troublesome and expensive. Inverting the ladle over a fire is difficult with a large ladle and may cause detachment of the refractory lining. Placing the ladle on its side and applying a gas or oil burner horizontally is better but still unsatisfactory. Keeping the ladle upright and applying the flame of the burner vertically downward is the most satisfactory method. In equipment recently designed for more efficient application of the last method, the ladle is closely covered by a shield in which chimneys are provided for escape of the burned gases. Air for combustion is introduced with a special air-jacketed burner which is actually capable of being operated under water. E.H.McC.

New refractory compositions resistant to molten rock phosphate. GORDON R. POLE AND ALFRED W. BEINLICH, JR. *Jour. Amer. Ceram. Soc.*, **26** [1] 21–37 (1943).—12 figures, 12 references.

PATENTS

Checkerwork construction. S. P. KINNEY (H. A. Brassert & Co.). U. S. 2,303,559, Dec. 1, 1942 (Dec. 15, 1941).

Checkerwork structure. H. R. HILLER AND H. W. WEBER (Laclede-Christy Clay Products Co.). U. S. 2,303,741, Dec. 1, 1942 (April 18, 1942).

Furnace arch nose construction. H. W. BEECHER (Gladding, McBean & Co.). U. S. 2,303,815, Dec. 1, 1942 (Nov. 20, 1939).

Furnace roof. R. P. HEUER (Harbison-Walker Refractories Co.). U. S. 2,304,170, Dec. 8, 1942 (June 24, 1939).

Manufacture of refractory materials. C.U.R.A. PATENTS, LTD., J. G. BENNETT, M. PIRANI, AND M. W. THRING. Brit. 549,142, Nov. 18, 1942 (March 14, 1941).

Refractory and method of making. EUGENE WAINER (Titanium Alloy Mfg. Co.). U. S. 2,306,349, Dec. 22, 1942 (April 18, 1940).—A composition suitable for forming refractory structures comprising a major quantity of zirconium oxide, a minor quantity of a glass melting or softening below 1700°F., a minor quantity of an alkali metal pyrophosphate having an empirical composition between $M_4P_2O_7$ and $M_6P_4O_{13}$, where M represents an alkali metal, and water.

Removing iron from magnesium. G. E. HOLDEMAN (Dow Chemical Co.). U. S. 2,304,092, Dec. 8, 1942 (Dec. 16, 1941).—The method of removing dissolved iron impurities from molten iron-contaminated magnesium which comprises incorporating beryllium into the molten metal in a proportion sufficient to precipitate the iron impurities and separating the precipitated impurities from the molten metal.

Removing iron from magnesium alloys. G. E. HOLDEMAN (Dow Chemical Co.). U. S. 2,304,093, Dec. 8, 1942 (Dec. 16, 1941).—The method of removing dissolved iron impurities from molten iron-contaminated magnesium-base alloys which comprises incorporating beryllium into the molten metal in a proportion sufficient to precipitate the iron impurities and separating the precipitated impurities from the molten metal.

Terra Cotta

Chemical stoneware containers. Recent developments by Eyles. ANON. *Chem. Age* [London], **46** [1200] 315–16 (1942).—British chemical stoneware equipment is made from high-grade pottery clays of which Britain possesses abundant deposits. It is finding ever-increasing applications as the use of other material is restricted. Applications are described. Special hollow stoneware blocks 14 in. wide and 10 in. high can be used for building wall structures suitable for silos, tanks, crystallizing compartments, etc. For storing acids and other corrosive liquids the blocks can be joined and reinforced with acid-resisting cement. The container is built up from two basic types of stoneware blocks which fit together and are locked in place by means of pins of the same material. No special skill is called for in erection, and containers of almost any shape or diameter can be constructed. These blocks can also be used for walls and temporary buildings See *Ceram. Abs.*, **22** [1] 12 (1943). A.B.S.

Manufacture of whiteware wall tile. B. BASSA. *Keram. Rundschau*, **46** [27] 299–302; [28] 315–17 (1938).—B. gives a detailed account of the steps involved in the manufacture of whiteware wall tile. M.V.C.

PATENT

Salt glazing. E. A. STEWART. U. S. 2,305,908, Dec. 22, 1942 (Oct. 25, 1940).—The method of salt glazing ceramic ware which comprises volatilizing alkaline chloride in a kiln containing the ware during the firing thereof to produce a salt glaze upon the ware, cooling the ware down to the point where the salt glaze crazes, and then refiring the salt-glazed ware.

Whiteware

Application of metallic soaps. STANLEY B. ELLIOTT. *Enamelist*, **19** [10] 25–27 (1942).—A classification of metallic soaps is based on the properties which determine how such soaps shall be used. These properties are (1) the ability to dissolve in organic solvents and supply metal cations, (2) the ability of the soap to influence the characteristics of the liquids in which it is dispersed, and (3) the physical characteristics of the soap. In the ceramic industry, metallic soaps have been used for many years as a coating for ceramic glazes. They may be easily diluted to low metal concentrations, so that very thin films of oxide or metal are deposited on the removal of the organic material. Other uses for such metallic soaps and resinates are discussed. See *Ceram. Abs.*, **21** [9] 194 (1942). L.E.T.

Improved ceramic dielectric materials. M. D. RIGTERINK. *Rev. Sci. Instruments*, **12** [11] 527–34 (1941).—The properties of ceramic materials used for electrical insulation apparatus are described in detail; the materials include steatite, cordierite, and titanium dioxide. These materials possess high mechanical strength, resistance to cold flow, ability to withstand high temperatures, high dielectric strengths, resistance to all chemical agents except hydrofluoric acid, and low porosities. Steatite ceramics are characterized by their extremely low dielectric losses and their high insulation resistances and are therefore especially useful for general insulation purposes at high frequencies and high temperatures. Steatite bodies are prepared from mixtures of 60% or more of talc ($3MgO\cdot 4SiO_2\cdot H_2O$), 30% or less of clay ($Al_2O_3\cdot 2SiO_2\cdot 2H_2O$), and the remainder usually of alkali or alkaline-earth oxides. Organic binders and plasticizing agents are often added to steatite bodies for the forming processes. The steatite body approaches the composition of the mineral steatite ($3MgO\cdot 4SiO_2\cdot H_2O$). The steatite ceramics differ from porcelains in both crystalline and glass phases; the crystalline mag-

[NOTE: This table accompanies the abstract entitled "Improved ceramic dielectric materials," p. 33.]

PROPERTIES OF CERAMIC MATERIALS

Properties	Unit of measurement	Electrical porcelain	Steatites	Fused quartz	Cordierite ceramics	Titanium dioxide ceramics	Magnesium titanate ceramics	Titanium dioxide-zirconium dioxide ceramics
Specific weight	gm./cm.³	2.3–2.5	2.5–2.8	2.2	2.1–2.2	3.9	3.1–3.2	3.6
Water absorption	Weight absorbed (%)	0–2.0	0–0.1	0	0–1.0	0	0	0
Modulus of rupture	lb./in.²	6000–12,000	17,000–24,000	10,000	7000–12,000	14,000–21,000	11,000–16,000	13,000–21,000
Tensile strength	lb./in.²	2000–7000	7000–13,000	8000–15,000	2000–5000	4000–8000	8000–12,000	4000–7000
Compressive strength	lb./in.²	40,000–60,000	80,000–120,000	20,000–30,000	40,000–60,000	80,000–160,000	70,000–85,000	40,000–80,000
Linear coefficient of thermal expansion	c.g.s.	$3–5 \times 10^{-6}$	$6–9 \times 10^{-6}$	0.5×10^{-6}	$1–2 \times 10^{-6}$	$7–8 \times 10^{-6}$	$6–10 \times 10^{-6}$	$6–7 \times 10^{-6}$
Thermal conductivity	c.g.s.	0.0025	0.006	0.0036	0.003	0.010	0.010	
Softening temperature	°C.	1500–1600	1250–1400	1450	1400	1500	1400	1500
Power factor at room temperature								
1 kc.	%	1.0–2.0	0.04–0.20	0.03	0.6–1.0	1.0–3.0	0.10	0.1–0.3
1000 kc.	%	0.7–1.2	0.03–0.20	0.02	0.4–0.7	0.06–0.15	0.02–0.10	0.05–0.10
Dielectric strength (0.2–0.25 in.)	volts/mil	200–280	200–300	150–200	100	100	150	150
Volume resistivity								
At 20 °C.	ohm-cm.	$10^{12}–10^{14}$	$>10^{14}$	$>10^{14}$	10^{13}	10^{4}	10^{14}	10^{13}
At 200 °C.	ohm-cm.	$10^{7}–10^{10}$	$10^{10}–10^{15}$	10^{13}	$10^{8}–10^{10}$	$10^{9}–10^{10}$	$10^{9}–10^{11}$	10^{8}
At 400 °C.	ohm-cm.	$10^{6}–10^{7}$	$10^{7}–10^{12}$	10^{9}	$10^{4}–10^{7}$	$10^{7}–10^{8}$	$10^{7}–10^{9}$	
At 600 °C.	ohm-cm.	$10^{4}–10^{5}$	$10^{5}–10^{10}$	10^{7}	$10^{4}–10^{6}$	$10^{5}–10^{6}$	$10^{6}–10^{7}$	
Dielectric constant at room temperature		5–7.5	5.5–7.5	4	5–5.5	70–90	12–18	40–60
Capacitance change per °C.			$+1.5 \times 10^{-4}$		$+5 \times 10^{-4}$	-6.5×10^{-4}	$\pm 0.5 \times 10^{-4}$	$\pm 0.5 \times 10^{-4}$

nesium metasilicate is present in steatites as contrasted with mullite and quartz embedded in an alkali glass matrix. The sodium and potassium ions in the porcelain glass phase are detrimental to dielectric properties. Cordierite ceramics have low coefficients of thermal expansion and are used for coil forms for radio transmitting. The cordierite ceramics are made from talc, clay, and alumina so as to produce a body containing cordierite crystals ($2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$). Cordierite has a short firing range. The low coefficient of expansion of cordierite products has made them useful for laboratory bench tops, crucibles, and evaporating dishes. Titanium dioxide ceramics find use in condensers which require high mechanical stability, high capacities in relatively small volumes, and zero to large negative temperature coefficients of capacity. A table of properties is given. R.H.B.

Moisture-impervious porcelain has new design possibilities. R. L. WHITNEY. *Product Eng.*, **13** [12] 723–25 (1942).—A new type of porcelain, Prestite, is produced from native flint, feldspar, china clay, ball clay, and water; it can be glazed, ground accurately, and cored. It is dense, impervious to moisture, and much stronger than common plastics; its unglazed impact strength exceeds that of ordinary wet-process porcelain because of its freedom from unrelieved stresses. Temperatures up to 1470°F. do not weaken its mechanical strength or distort its shape, and it does not soften up to 2190°F. Its heat conductivity is 0.022 watts per in.² in. °C. Its physical properties are as follows:

Compressive strength	48,000 lb./sq. in.
Tensile strength	5000 lb./sq. in.
Modulus of rupture	11,000 lb./sq. in.
Resistance to impact ($4^1/_2$ in. lever arm)	88 lb./sq. in.
Cantilever strength	1600 lb./sq. in.
Porosity	None
Specific gravity	2.40
Weight by volume	11.37 cu. in./lb.
Impact (Charpy)	1.75 kgm. in.²/cm.²
Hardness (Herbert pendulum)	Scale: 85–100
	Time hardness: 85–100
Diamond pyramid	418

(Fully hardened high-speed steel = 860; W steel = 510)

The high dielectric strength is retained up to 390°F. Volume resistivity is 12×10^{12} ohms per cc. Prestite is chemically inert to alkalis, oil, gases, water, and all acids except HF. Volumetric shrinkage is 30%. Full strength is developed after firing. Glazing may be applied but serves only to produce a smooth, easily cleaned surface or to give a desired appearance, as Prestite is nonhygroscopic. Machining must be done before firing; for grinding to size or rough-grinding fired Prestite, a 35- to 50-grit hard bond wheel is used, rotating at 5000 to 5500 peripheral ft. per min. under a pressure of 30 to 40 lb. Thin sections must be ground wet; heavy stock with only slight removal of material can be ground dry, but overheating must be avoided as it causes cracks. Fine finishes are obtained with 240- to 250-grit aluminum oxide wheels, medium to hard bonds, and feed pressures of 25 to 30 lb. See "Porcelain . . .," *Ceram. Abs.*, **21** [11] 237 (1942). M.HA.

Tests on whiteware materials: Raw materials tests. W. H. EARHART AND J. H. KOENIG. *Bull. Amer. Ceram. Soc.*, **22** [1] 8–11 (1943). **Raw materials standards and specifications.** B. C. BURGESS. *Ibid.*, p. 11. **Body tests.** R. F. GELLER. *Ibid.*, pp. 11–14. **Glaze tests.** R. F. GELLER. *Ibid.*, p. 14.

PATENTS

Apparatus for manufacturing pottery ware. W. J. MILLER. U. S. 2,303,889, Dec. 1, 1942 (May 24, 1938; Dec. 2, 1940).

Ceramic insulating composition. W. H. GERISCH (General Electric Co.). U. S. 2,304,562, Dec. 8, 1942 (Dec. 18, 1941).—A refractory silica insulator comprising

a vitrified mixture of magnesium oxide in major proportion no less than about 65%, a borosilicate glass present to the extent of at least about 5%, and a complementary proportion of clay.

Ceramic material made of magnesium titanate and method of preparing. HANS THURNAUER (American Lava Corp.). U. S. 2,305,327, Dec. 15, 1942 (June 27, 1938).—The method of producing electrical insulating material of magnesium titanate which comprises sintering a mixture of magnesium oxide and titanium dioxide, reducing the sintered product to a powder, forming the powder into a predetermined shape, and finally firing the shape so formed to vitrify it.

Combination sagger and setter for bisque firing vitrified china. J. R. GEDNETZ (Gladding, McBean & Co.). U. S. 2,306,433, Dec. 29, 1942 (Nov. 20, 1940).

Cutting off plastic ceramic bodies from parent masses. W. J. MILLER. U. S. 2,303,888, Dec. 1, 1942 (May 8, 1940).

Method and apparatus for manufacture of pottery ware. W. J. MILLER. U. S. 2,303,887, Dec. 1, 1942 (May 24, 1938).

Porous ceramic insulating material. ALFRED UNGEWISS (vested in the Alien Property Custodian). U. S. 2,303,964, Dec. 1, 1942 (April 5, 1938).—A ceramic insulating body for use in high-frequency engineering, the body consisting of grains sintered together only at their contacting points and constituting a finely porous structure in which the pores constitute at least 10% of the bulk, the body being workable by the usual tools at the usual speeds in turning, fraising, and boring metal, having a dielectric loss of $tg\ \delta$ of less than $20\times10^{-4}=300$ m. and a dielectric constant of between 2.5 and 6, and having the composition resulting from firing together ceramic materials, at least 50% of the materials being of the group consisting of magnesia-alumina spinel and forsterite, approximately 13% of the material being alkali-free plastic clay, and the remainder of the materials being prefused oxide of alkaline-earth metal.

Process and apparatus for the production of spark-plug insulators. EMIL KLINGLER, GERHARD WEITBRECHT, AND EUGEN DREHER (vested in the Alien Property Custodian). U. S. 2,305,877, Dec. 22, 1942 (June 30, 1939).

Spark plug. GENERAL MOTORS CORP. Brit. 549,281, Nov. 25, 1942 (Jan. 18, 1941).

Equipment and Apparatus

Conductance electrostatic separator. FOSTER FRAAS. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1511; *Mining Tech.*, **6** [5] 10 pp. (1942).—F. investigated the simple roll-type machine. When homogeneous particles are separated and the successive residues are repassed, the weights deflected will fall on a straight line if plotted against the pass number on a semilogarithmic graph. The amount of material deflected at pass n is $W_n = P(1 - P)^{n-1}D$, when n, P, and D are, respectively, the pass number, the probability of deflection, and the total amount deflected at the rate P. P varies with the electrical potential according to the equation $P = q \log V - r$, where V is potential and q and r are constants depending on the units of V, apparatus dimensions, and particle conductance. During separation, the interfacial area or interfacial conductance has a different value each time the particle is in contact with the roll. The behavior of particles is therefore a probability and not a certainty. If the particle is in contact with the charging surface many times, an average value of the interfacial area is obtained, and the probability is replaced by a certainty as to the path the particle follows. This may be obtained by charging the particles while passing over one roll and then separating them on the second roll. W.D.F.

Determination of fineness by means of the photocell. KIMBE CHUJO AND YASUMASA SUZUKI. *Concrete, Cement Mill Ed.*, **49**, 186–88 (1941).—With a turbidimeter of the Wagner type, the cement particles coagulate in the dispersion medium composed of kerosene plus a little oleic acid. Absolute alcohol is recommended as a substitute. A supposed constant in the Stokes' law formula has been found to vary with particle size. W.D.F.

Grading of material. W. F. CAREY. *Proc. Inst. Mech. Engrs.* [London], **141** [6]; reprinted in *Gas Jour.*, **231**, 164–65 (1940).—C. describes a method for giving a high yield of closely graded material, e.g., between 500 and 100 μ, which depends on producing a ribbon of the oversize grains several grain sizes thick. This ribbon is passed between rolls where its thickness is reduced, e.g., from five particles to four, thus forming fines by rubbing corners off the particles. The system is applicable to brittle materials (coal, granite, and anhydrite) and to soft amorphous materials. A full-scale machine crushed material originally between $^3/_4$- and $^3/_8$-in. mesh (19,000 to 9500 μ) to 1675 to 420 μ with a loss of only 15%. Two precrushing stages were used to ensure small reduction ratios. L.R.B.

Grating spectrograph of fabricated steel. J. W. FORREST AND H. W. STRAAT. *Jour. Optical Soc. Amer.*, **32**, 669–71 (1942).—The Bausch & Lomb Optical Co. has developed a Wadsworth type grating spectrograph. The mechanical structure and performance characteristics of the instrument are described. A.P.

Industrial space heating. ANON. *Gas Jour.*, **232**, 22–25 (1940).—The advantages of space heating by surface-combustion overhead radiators for factories and workshops include (1) flexibility, (2) a cool air temperature, reducing stuffiness, (3) the fact that the heat is seen which gives psychological satisfaction as does sunlight, and (4) the usual advantages of gas. The radiators have a surface temperature of 2000°F. and operate on compressed gas. Operating costs under different conditions are given. L.R.B.

Infrared radiation and equipment. R. MAXTED. *Trans. Illum. Eng. Soc.* [London], **7** [1] 1–14 (1942).—Radiant-heating technique still depends rather more on direct experiment than upon a full understanding of wavelength effects, the properties of materials, or the physics of processes. If optimum combinations of materials and wave bands are to be selected, a thorough knowledge of the spectral characteristics of materials is needed. One effect of the absorption of radiant energy is the transformation of the radiation into sensible heat within the absorbing material. Radiant heating depends solely upon this effect, and heat is received by the absorbing material instantly upon exposure to the radiation. The terms "radiant heat" and "heat rays" are usually applied exclusively to the infrared wave lengths, but the essential effect is by no means confined to this region. The usual purpose of radiant heating is to produce a change in state or structure, as in dehydration or the drying of enamels. An enameled metal sheet may be irradiated from the back, or a transparent lacquer may be heated partly by absorption in the underlying substance. Much work remains to be done in determining the spectral characteristics of materials in common use, and the preparation of these data must be regarded as an essential first step in the effective development of radiant heating. Present-day practice is concerned primarily with the heating of paint and water films, similar partly transmitting materials, and iron or steel sheets. Electrical energy is efficiently converted into radiant energy by the filament lamp, but the over-all efficiency of a heat process rests on two factors: efficiency in directing energy to the work and effective absorption by the work. By the instant transfer of heat to the material, processing times are drastically cut. A reduction in firing time from hours to minutes is often claimed for infrared equipment. When such results were first obtained, they were frequently attributed to catalytic or direct action of the radiation. M. and his colleagues demonstrated in 1935 that this was not an explanation, as identical enameled steel sheets were heated by irradiating, in one case,

the painted face and, in the other, the back surface. Similar results were obtained at similar firing temperatures. It is sometimes thought that the "nature" of an enamel may be lost or its protective properties impaired by the rapid attainment of firing temperatures, but the evidence is to the contrary, and it is generally found that both evaporation and polymerization are more complete and especially deeper in the paint film. As in lighting, the engineering problem has four main aspects: the measurement of energy, the determination of flux density required, the design of reflectors, and the planning of installations. The practical choice, therefore, lies mainly between gold and anodized aluminum and must be decided by the nature of the work or by economies. The application of automatic conveyer and tunnel equipment is discussed. H.K.R.

New multiple shunt extends usefulness of galvanometers. ANON. *Laboratory*, **13** [4] 84–85 (1942).—The Fisher Ayrton shunt, when used with a galvanometer, permits the measurement of current in steps of 1, 2, 5, 10, 20, 50, 100, 200, and 500 times its ordinary range. This allows a greater angle of deflection and thus more accurate reading of the galvanometer. W.D.F.

Quartz gives radio sharper ears. ANON. *Popular Science*, **141** [5] 82–84 (1942).—Steps in the inspection, cutting, orientation, grinding, and testing of quartz crystals are illustrated. A.P.

Raw quartz crystals. C. F. BALDWIN. *Gen. Elec. Rev.*, **45** [7] 415 (1942).—Quartz crystals, which are used extensively in radio for controlling the frequency of transmitters, are obtained almost entirely from certain parts of Brazil. The following crystals are shown: (1) full prismatic quartz crystal, (2) irregular quartz crystal, (3) peak prismatic quartz crystal, and (4) river quartz crystal. The latter name is derived from the fact that the crystals were broken off by nature ages ago and rolled around by water until the continual abrasion produced a form approaching a sphere. L.E.T.

Stigmatic grating spectrograph for industrial laboratories. R. F. JARRELL. *Jour. Optical Soc. Amer.*, **32**, 666–69 (1942).—J. describes a commercial spectrograph using a Wadsworth mounting. A.P.

Surface replicas for use in the electron microscope. V. J. SCHAEFER AND D. HARKER. *Jour. Applied Physics*, **13**, 427–33 (1942).—In making replicas of surfaces, the surface is cleaned and then coated with a thin wedge-shaped film of polyvinyl formal ranging from 500 to 750 a.u. in 2.5 cm. Procedures for checking film thicknesses are described. Methods for mounting specimens on the film include a conditioning treatment useful in mounting water suspensions. Five photomicrographs show results obtainable. A.P.

Unique temperature indicators called "Tempilstiks." ANON. *Laboratory*, **13** [4] 86–87 (1942).—Tempilstiks look like colored crayons but are made of materials that melt at specific temperatures. Marks made with them on any surface become shiny in appearance when their melting point is reached. They are available in the range 125° to 700°F. and are accurate to within 1% of the stated temperature. Each Tempilstik is a different color for easy identification. W.D.F.

PATENTS

Electron-optical lens. BODO V. BORRIES AND ERNST RUSKA (vested in the Alien Property Custodian). U. S. 2,305,761, Dec. 22, 1942 (March 7, 1939).

Measuring prism for refractometers. GERHARD HANSEN AND HANS GEHNE (vested in the Alien Property Custodian). U. S. 2,305,777, Dec. 22, 1942 (Nov. 25, 1940).

Microscope objective. E. O. BERNHARDT (vested in the Alien Property Custodian). U. S. 2,305,760, Dec. 22, 1942 (Nov. 25, 1940).

Kilns, Furnaces, Fuels, and Combustion

Analysis of coal. L. COCHRANE. *Gas World* [Ann. Coal and Coke Handling Supp.], pp. 9–10 (April 23, 1938).—C. describes the actual methods used by the Fife Coal Co. for the preparation and analysis of coal samples; the methods are recommended by the Fuel Research Board of Great Britain and the British Standards Inst. L.R.B.

Firing and kilns in small potteries. ANON. *Keram. Rundschau*, **46** [36] 403–405 (1938).—Small plants which have not kept up with modern firing technique can remodel old kilns according to the plans described and diagramed. The kilns are coal fired and assure the correct distribution and circulation of gases, a draft which is not too strong or too weak, and an economical and efficient operation. Minor adjustments can be worked out by a competent engineer, but where remodeling is found disadvantageous, an entirely new modern furnace should be constructed. M.V.C.

Gas in the ceramic and allied industries. ANON. *Gas Jour.*, **231,** 25 (1940).—In Stoke-on-Trent many conversions from coal to town gas have been made for drying and firing pottery, electrical porcelain, tile, etc. A case is mentioned in which a muffle of 40-cu. ft. capacity was in operation within 5 days of an inquiry, during which time drawings were prepared, quantities were worked out, burners were made, and the furnace was built. L.R.B.

Gas for ceramic firing. ANON. *Gas Jour.*, **227,** 330 (1939).—The gas used for pottery firing in Stoke-on-Trent, England, rose from less than 100 million cu. ft. in 1933–1934 to 1341 million cu. ft. in 1938–1939 (calorific value = 470); 66 town-gas-fired tunnel kilns were in operation in 1939. The gas was used chiefly for the firing of biscuit and glost earthenware and tile at temperatures between 1050° and 1250°C., but it has also been used for decoration. L.R.B.

Gas-fired tunnel furnace. ANON. *Gas World* [Ind Gas Supp.], **9** [6] 16–17 (1937).—The open-flame tunne kiln developed by the Société des Fours Industriels et Métallurgiques (Sofim) for firing porcelain and other ceramic materials is described and illustrated. See "Tunnel . . .," *Ceram. Abs.*, **18** [3] 82 (1939). L.R.B.

Industrial gas applications. G. M. PARKER. *Gas Jour.*, **231,** 291–93 (1940).—The application of natural gas to large installations using cheaper fuels such as producer gas has been on the basis of interconvertibility, so that the new fuel could be used at the off-peak times when a lower tariff is usual. The natural gas is then cracked *in situ* to give fuels of lower calorific value. Other conversions were made from oil or pulverized-coal firing, the necessary equipment for firing the latter being incorporated in the natural-gas burners. Burner installations in an open-hearth and a glass-tank furnace, a Hawley-Schwartz converter for melting brass, etc., and a rotary melting furnace, a rotary cement kiln, a rotary titanium calciner, and a top-fired recuperative open-hearth furnace are described. The last conversion was not successful. See *Ceram. Abs.*, **20** [1] 25 (1941). L.R.B.

X-ray study of carbonization. Annual Report of the Northern Coke Research Committee. *Gas Jour.*, **231,** 197 (1940).—A study of crystallite growth during the carbonization of coals, lignin, turf, and peat up to a maximum temperature of 2200°C. was made by X rays. Below a carbonization temperature of 1300°C. the crystallites were very small (10 to 35 a.u.). Above that temperature, growth commenced. Those formed from peat but not from turf showed an unusually rapid growth in the interval 700° to 1000°C. Coalification was studied by X rays in a series of coals of different rank from the same seam, varying in volatile content from 36.1 to 10.3%. The *a* dimension of the crystallite remained constant at 11 a.u., but the *c* dimension rose from 15.4 to 19.6 a.u. A plea is made for

quick tests on coke combustibility, such as ignition tests. The ignition temperature of coke reaches that of graphite as the carbonization temperature is raised to 2400°C. Cokes and chars prepared below 550°C. showed two ignition temperatures at about 250°C. and 300° to 400°C. It is inferred that the ignition of these low-temperature cokes and coals was initiated by oxidation of complex hydrocarbons rather than by the carbon-oxygen reaction. See "Recent . . . ," *Ceram. Abs.*, **19** [8] 197 (1940). L.R.B.

SEPARATE PUBLICATIONS

Analyses of Illinois Coals. ANON. *U. S. Bur. Mines Tech. Paper*, No. 641, 245 pp. (1942). Supt. of Documents, Washington, D. C. Price 30¢.—The principal facts regarding occurrence, reserves, quality, characteristics, production, and uses of Illinois coals are presented. R.A.H.

Hydrogenation and Liquefaction of Coal: II, Effect of Petrographic Composition and Rank of Coal. C. H. FISHER, G. C. SPRUNK, A. EISNER, H. J. O'DONNELL, L. CLARKE, AND H. H. STORCH. *U. S. Bur. Mines Tech. Paper*, No. 642, 162 pp. (1942). Supt. of Documents, Washington, D. C. Price 25¢.—A fairly complete picture of the relation between the nature of coal and many of its hydrogenation characteristics has been established as a result of this investigation. See *Ceram. Abs.*, **20** [8] 201 (1941). R.A.H.

Mineral Matter in Coal. GEORGE C. SPRUNK AND H. J. O'DONNELL. *U. S. Bur. Mines Tech. Paper*, No. 648, 67 pp. (1942). Supt. of Documents, Washington, D. C. Price 15¢.—The authors describe the occurrence and distribution of the most important microscopic forms of mineral matter in coal. Minerals were identified in thin sections of coal from about 100 coal beds by means of the petrographic microscope. See *Ceram. Abs.*, **21** [9] 195 (1942). R.A.H.

PATENT

Muffle kilns. BONNYBRIDGE SILICA & FIRECLAY CO., LTD., AND W. MCBRYDE. Brit. 549,273, Nov. 25, 1942 (Sept. 17, 1941).

Geology

Absorption of proteins by montmorillonitic clays and its effect on base-exchange capacity. L. E. ENSMINGER AND J. E. GIESEKING. *Soil Science*, **51** [2] 125–32 (1941).—Wyoming bentonite and Hartsburg bentonite were brought into alkaline suspension, mixed with an alkaline suspension of various proteins (including hemoglobin, casein, protamine, pepsin, pancreatin, gelatin, and modifications of these obtained by nitrous acid treatment and formaldehyde treatment), and then acidified to a definite pH with acetic acid. X-ray diffraction methods were applied to the dried complexes, and the base-exchange capacity was determined on both dried and moist complexes. Data are given indicating that proteins are adsorbed as cations within the (001) spacings of montmorillonite with accompanying extension of the lattice spacing. The Hartsburg colloid contained montmorillonite clay which absorbed large ions within the (001) spacing, but this was found to be less extensible than that of montmorillonite and reached a maximum of only 17.5 a.u. Albumen was found to be absorbed from alkaline solution, but less strongly than gelatin. Absorbed proteins reduced the base-exchange capacity of clays to a degree depending on the amount and nature of the protein. Proteins did not reduce the base-exchange capacity in an alkaline medium, the reduction increasing with decreasing pH. This was taken to indicate that the proteins were absorbed as cations. The formaldehyde and nitrous acid treatments, which altered the basic properties of the proteins, resulted in less absorption. V.D.F.

Alunite and alunite deposits of the eastern Kazakstan. P. S. MARKOV. Contributions to the Geology of Central Kazakstan; Results of an Expedition to Central Kazakstan in 1936–1937, pp. 121–41. Acad. Sci. U.S.S.R., 1940; *Khim. Referat. Zhur.*, **4** [2] 32 (1941).—The chemical analysis of the alunites is given. They are distinguished by their K content and by the presence of Mo, Ni, and Co. M.Ho.

American synthetic emerald. AUSTIN F. ROGERS AND FRANCIS J. SPERISEN. *Amer. Mineralogist*, **27**, 762–68 (1942).—Synthetic emerald has been made by Carroll F. Chatham, San Francisco; the method cannot be disclosed. Prismatic crystals have been made up to the size of one carat and of good quality, comparable to Colombian emeralds. The chemical analysis shows silica, alumina, beryllia, some chromium oxide, small amounts of alkalis, and other material. Optical tests prove that the crystals are emerald. They are slightly pleochroic and show certain optical anomalies. The synthetic emerald is distinguished from natural emerald by the character of the inclusions. W.D.F.

Artificial cryolite—production by fusion method. ANON. *Chem. Trade Jour.*, **107** [2792] 304 (1940).—A method for the manufacture of SiO_2-free cryolite by the reaction of AlF_3 with alkali-metal silicofluorides at high temperature is described in Brit. Pat. 526,921, Oct. 9, 1940 (March 30, 1938) by the Silikon G.m.b.H. Ausarbeitung und Verwertung Industrieller Verfahren: 100 gm. dry AlF_3, obtained, e.g., by treatment of alumina, are intimately mixed with 30 to 35 gm. of Na_2SiF_6, obtained from H_2SiF_6 products by treatment of kaolin, and then heated for 1 hr. in an inert atmosphere at 450° to 500°C. in a rotating tube. The yield of Na_3AlF_6 is nearly quantitative. L.R.B.

Brazilian chromite. ANON. *Chem. Trade Jour.*, **110** [2860] 270 (1942).—The principal sources of chromite in Brazil are in Bahia, near Santa Luzia and Campo Formoso; in the latter district three deposits are being worked, two of which contain 41.60 Cr_2O_3, 18.19 FeO, and 12.40% SiO_2 (Cascabulhos) and 51 Cr_2O_3, 18 FeO, and 9% SiO_2 (Pedrenhas). Production figures are given. L.R.B.

Brazil's strategic mineral resources. C. W. WRIGHT AND THOMAS FRASER. *Mining Congr. Jour.*, **28** [10] 38–43 (1942).—Brazil has large deposits of iron, manganese, chromite, and nickel and smaller deposits of cobalt, copper, lead, and zinc. Bauxite is found in extensive areas, and there are important deposits of beryl. The production of tantalite is increasing rapidly and will make Brazil the leading producer; columbite is also found. Rutile is produced principally for use as welding-rod coatings. At the beginning of the war Brazil was the main source of supply of industrial diamonds for Germany, Italy, and Japan. Brazil is the second largest exporter of muscovite mica and is the only important producer of piezoelectric quartz crystal. Zircon is found in beach sands mixed with rutile, ilmenite, and monazite; such zircon is generally stained and not too desirable. Zircite or baddeleyite is found in gravel beds; it is used as ferrozirconium or as the oxide. A little asbestos, not of spinning grade, is produced. Extensive deposits of magnesite are being explored. W.D.F.

Colloidal constituents of American alkali soils. W. P. KELLEY, W. H. DORE, AND J. B. PAGE. *Soil Science*, **51** [1] 101–24 (1941).—Seven soils of the black-alkali type and three of the white-alkali type from various localities in the western U. S. were separated by sedimentation, and the particles less than 1 μ in diameter were studied by chemical analysis, base-exchange capacity measurements, dehydration curves, and X-ray diffraction. These colloids were found to be high in SiO_2 and CaO (probably as $CaCO_3$) with SiO_2/Al_2O_3 ratios greater than 4.0 and base-exchange capacities of 25.7 to 58.4 m.e. Micalike clays predominate in the black-alkali soils, while the white-alkali soils contain a mixture of montmorillonitic, kaolinitic, and micalike clays. $CaCO_3$ was generally absent in the white-alkali colloids but was evidenced by sharp breaks in the dehydration curves of the black-alkali soils. No evidence was found for the theory that the base-ex-

change capacity of soil colloids is necessarily due to montmorillonite. The data are discussed in relation to Sedletskiĭ's work on Russian soils (see "Genesis . . . ," *Ceram. Abs.*, **20** [3] 75 (1941)). 21 references. V.D.F.

Concretions and refractory deposits in some Natal coastal soils. B. E. BEATER. *Soil Science*, **50** [5] 313–30 (1940).—B. describes concretions and residues in Natal and Zululand coastal soils and discusses their mode of genesis. The concretionary forms are distinct for each soil type and permit rough prediction of the geological soil type in which they were formed. 2 figures. V.D.F.

Dolerite plugs in Antrim. S. I. TOMKEIEFF. *Geol. Mag.*, **77** [1] 54–64 (1940).—At Tieveragh near Cushendall, County Antrim, Ireland, a volcanic neck infilled with dolerite occurs. It is of interest because it has metamorphosed the country rock into buchite containing cordierite and other minerals. At Tievebulliagh, 3 m. to the southwest, is another dolerite plug, hitherto unrecognized as such. A rock among its scree is similar to baked shale or porcellanite, containing 36% SiO_2 and 61% R_2O_3 with only traces of CaO and MgO. It is tentatively said to be metamorphosed aluminous pisolitic iron ore or ferruginous bauxitic clay and appears to contain sillimanite or mullite with a refractive index of 1.59 to 1.63, moderate birefringence, and straight extinction. L.R.B.

Lamellar structure in orthopyroxenes. N. F. M. HENRY. *Mineralog. Mag.*, **26** [176] 179–89 (1942).—Previous statements regarding the common lamellar structure in orthopyroxenes are reviewed. New X-ray evidence is produced together with the results of optical examination of specimens from Baste, Harz (Germany), Glen Buchat, Aberdeenshire (Scotland), and elsewhere. H. concludes that the lamellas are composed of the same orthorhombic material as the main crystal and that the visibility of the structure is due to differences in extinction position between the sets of lamellas. These sets of lamellas have their *a* and *c* axes displaced relative to those of the main crystal in, or nearly in, the *ca* planes at angles up to about 10° to 15°. This structure appears to be due to deformation and is evidently formed during crystallization. L.R.B.

Microscopic method for determining the water-stable aggregates in soils. JOHN B. PETERSON. *Soil Science*, **50** [5] 331–38 (1940).—A method of studying the natural water-stable structures of soils was developed by slaking the sample in water and distributing the particles and aggregates in glycerine for microscopic examination. Tests on samples from the B horizon of Tama silt loam indicated that glycerine did not have any measurable effect on aggregation and that the presence of large particles did not affect the distribution of small particles settling near them. The effect of slaking time and the time of shaking in water are discussed. V.D.F.

New Riverside, producer of barytes in Georgia. A. H. HUBBELL. *Eng. Mining Jour.*, **143** [10] 62–65 (1942).—This mining operation, in Bartow County, is the largest single barytes operation in the U. S. Ocher was mined first and still is to some extent. The barytes is mined in five open pits. Overburden varies from nothing to 60 ft. Barytes occurrences are pockety and hard to discover. The ore is washed in a double log washer and ground and screened preparatory to being treated in four-cell Harz jigs. Material from the fourth cell goes through a four-cell scalper jig. Tailings from the jigs go to waste. Fines passing a 12-mesh screen are run over tables. The washing-plant capacity is 100 tons per hr. About 1 ton of washed product is separated from 8 tons of feed. A high-intensity magnetic separator removes iron from low-grade ore to make the lithopone grade and from the glass ore to make glass grade. The three grades of product sold are (1) low grade, for drilling muds, 92% $BaSO_4$ and 5% iron; (2) lithopone grade, at least 96% $BaSO_4$ and less than 1.0% iron; and (3) glass ore, at least 98% $BaSO_4$ and less than 0.2 or 0.3% iron. W.D.F.

Occurrence of ilsemannite. E. D. GOLDRING. *Amer. Mineralogist*, **27**, 717–19 (1942).—Ilsemannite occurs in the fluorspar mine of the Western Fluorspar Corp. in northern Jackson County, Colo., as a blue incrustation on the drift walls. It is more frequent near a fault. The country rock is pre-Cambrian granite. Associated with the ilsemannite are quartz, feldspar, fluorite, ocher, chlorite, pyrite, gypsum, and melanterite. W.D.F.

Origin of the name "quartz." S. I. TOMKEIEFF. *Mineralog. Mag.*, **26** [176] 172–78 (1942).—Quartz was called "crystal" from the time of Theophrastus, the pupil of Aristotle, until the 18th century, when the name "quartz" replaced it. The name "quartz" was first used in a book anonymously published at Augsburg in 1505. T. believes that it was a shortened form of *querkluftertz* or cross-vein ore. In the Erzgebirge mountains, silver is found in small cross veins composed of silica. In Cornwall, England, the name for crystalline silica used to be "cross-course spar," spar being formerly used synonymously with quartz. E. Brown, writing of his experiences in Freiburg, first used the word quartz (quarts) in English, but it was still strange in the 18th century. The replacement of the word "crystal" arose from the growth of the study of crystals in general. L.R.B.

Oxidation-reduction potentials of arsenate–arsenite systems in sand and soil mediums. CLARK M. KEATON AND L. T. KARDOS. *Soil Science*, **50** [3] 189-207 (1940).—Measurements of pH and Eh (observed potential difference between the electrode and the standard normal hydrogen electrode) and the ratio of arsenate to arsenite were made in quartz sand, in a sandy soil, and in a clay soil to which 2% increments of ferric oxide, aluminum oxide, and 0.002 mm. and finer colloidal fractions of the same soils were added in turn and in which the original arsenate-arsenite ratio was varied. It was found that Peter's formula, $E = E_0 - \frac{RT}{nF} \ln \frac{(\text{Red.})}{(\text{Oxid.})}$, is valid for the arsenate–arsenite system under ideal conditions. Arsenite was oxidized upon the addition of ferric oxide with a corresponding reduction in redox potential. Alumina had no effect. The redox potential may be used in the study and interpretation of the general nature of the chemical processes in the soil and of the changes in these processes as affected by some external factor. A theoretical discussion is included. 45 references. V.D.F.

pH of soils at low moisture content. A. R. C. HAAS. *Soil Science*, **51** [1] 17–39 (1941).—An extensive study was made to determine the reproducibility of pH readings made in soils of low moisture contents under a variety of conditions. A Beckman pH meter with a shielded glass electrode and a sealed calomel electrode was used. In field experiments, the lowest values were obtained by placing the electrode in contact with the undisturbed soil; intermediate values resulted from inserting it in compacted soil at the bottom of a small hole, and maximum values resulted from removal of the soil to a Pyrex brand beaker where the electrode was compacted in it with considerable pressure. In cases of extremely small water contents in soils, it was found necessary to spread thin films of moisture over each soil particle in contact with the electrode. Intimate contact with the sensitive tip of the glass electrode is essential to obtain representative equilibria and accurate pH values. Experiments with quartz sands, quartz flour, and silicic acid with various buffer solutions are described to show the several possibilities of obtaining false values. With the techniques thus developed, a number of orchard soils were studied. V.D.F.

Power for mining silica. ANON. *Power Plant Eng.*, **46** [4] 68–72 (1942).—At Ottawa, Ill., is an almost pure deposit of St. Peter's sandstone. The few feet of earth overburden are removed by excavators, and the surface is swept clean. The sandstone is blasted down into the pit, and this blasting disintegrates the stone into small particles. Strong jets of water further reduce the size, wash the sandstone, and force it to a sump pit; pumps force it to the sump at the mill where it is purified by flotation, dried, and shipped. The principal power load is for pumping water, for power, and for light. Heat is required for drying and in winter for heating water for washing down the sand in the pit. Steam is supplied from three boilers, each of 455 h.p., to two turbine generating units

of 1250 kw. each. The sand is used primarily for molding purposes; other uses include sandblasting, building construction, stone sawing, refractory brick, glass, abrasives, and numerous chemical applications. W.D.F.

Quantitative mineralogical composition of the products resulting from the processing of the apatite-nephelite group from Kirovsk. B. N. MELENT'EV. *Ind. Capacity of Kola Peninsula (U.S.S.R.)*, **1940,** No. 1, pp. 7–12; *Khim. Referat. Zhur.*, **4** [1] 38 (1941).—The mineral fractions were separated by a combination scheme of fractionation. By the use of 0.5 *N* HNO_3, the minerals were separated into insoluble (pyroxene, feldspar, sphene, titanomagnetite, and lepidomelane) and soluble fractions (nepheline, apatite, eudialyte, and, partly, sprenstein). The silicic acid did not coagulate. The insoluble fraction was submitted to a magnetic separation whereby the titanomagnetite was separated. The nonmagnetic fraction was separated by gravity into fractions having a specific gravity less than 3 and those having a specific gravity greater than 3. In the latter were aegirite and sphene; these in turn were separated by dissolving in H_2SO_4. As a result of 11 analyses, the following composition is given: nephelite 58 to 63, apatite 8.8 to 12.5, pyroxene 14.1 to 16.2, sphene 3.6 to 6, titanomagnetite 1.00 to 1.46, and feldspar 5.4 to 6.9%. When peat tar was used as a floating reagent, the amount of apatite and nephelite increased in the tailings and the heavy minerals decreased. The use of soap gave reversed results. The investigation showed that a chemical analysis alone does not give a clear picture and that a rational mineralogical analysis should also be made. M.Ho.

Quest for antimony. FREDERICK H. DAKIN. *Eng. Mining Jour.*, **143** [9] 62–63 (1942).—Stibnite is frequently said to be the only commercial ore, but in Mexico the oxides senarmontite, valentinite, cervantite, and stibiconite constitute the largest portion of the antimony ores. Mexico also produces commercially kermesite, mixed oxide and sulfide, and livingstoneite. The livingstoneite is mined for its mercury content with antimony as a by-product. Mexican antimony ores occur principally as irregular masses in limestone. Nearly all antimony-ore production comprises hand sorting low-grade ores to obtain 50% antimony content. A jig may be used to concentrate the ores, but tables have not been successful. W.D.F.

Results of three years' examination of secondary quartzites of the eastern Kazakstan and the problem of alunites. N. I. NAKOVNIK. Contributions to the Geology of Central Kazakstan; Results of an Expedition to Central Kazakstan in 1936–37, pp. 11–20. Acad. Sci. U.S.S.R., 1940; *Khim. Referat. Zhur.*, **4** [2] 32 (1941). See Secondary . . .," *Ceram. Abs.*, **19** [1] 27 (1940). M.Ho.

Rock-drill lubricants. FLOYD R. ANDERSON. *Eng. Mining Jour.*, **143** [9] 49–51 (1942).—Specially compounded lubricants are desirable. The following properties are recommended: (1) Viscosity should be specified according to the temperature of operation; in case of doubt, an oil of lower viscosity should be used. An oil with little change of viscosity with temperature is to be preferred. (2) High film strength is necessary to prevent oil-film rupture; 8000 lb. per sq. in. and higher is desirable. (3) Enough saponifiable additive material should be present to prevent quick washing away of the lubricant, but not enough to cause excessive foaming. (4) The lubricants should be clean and free of acids. (5) Additions of drying oil or soap are not recommended. The quality of the oil, however, is only one factor in rock-drill lubrication. The proper oil volume should be maintained, the oil feed should be properly set, and care must be taken that the oil finds its way through the machine at all times. W.D.F.

Spatial distribution of minor elements in single crystals. C. FRONDEL, W. H. NEWHOUSE, AND R. F. JARRELL. *Amer. Mineralogist*, **27,** 726–45 (1942).—The growth of a crystal proceeds outwardly from an original nucleus. It is shown spectrographically that the minor foreign elements present in single crystals of galena and calcite are not uniformly dispersed throughout the host crystal but generally are distributed in adjoining or alternating regions of greater and lesser concentration. These concentration regions are related to the growth surfaces of the host crystal and fall into two types: (*A*) Pyramidal regions, or face loci, subjacent to particular faces on crystals bounded externally by several crystallographically different forms. The concentration differences arise in the unequal adsorptive capacity of the different forms on the growing crystal for the foreign element in question. (*B*) Alternating zones parallel to the external growth surfaces without any or marked selectivity as to different crystal faces. Growth zoning may have two origins: (1) a roughly periodic variation in the rate at which foreign material is taken up by the host crystal in a closed system under the control of certain properties peculiar to growth surfaces, and (2) a zoning occasioned by progressive variation in the composition of the crystallizing solution or in other outside factors. W.D.F.

Spectrographic data concerning the presence of the less common elements in rocks. GERALD O. FREEMAN. *Amer. Mineralogist*, **27,** 776–79 (1942).—Spectrographic analyses of 425 rocks were made by a commercial laboratory in Seattle, Wash. Cu, Ti, V, Cr, Mn, Ni, Ba, and Pb were found in 95 to 99% of the rocks analyzed; Sn, Co, and Sr, in 71 to 90%; Ag and Ga, in 41 to 70%; Zr, Zn, Bi, and Mo, in 11 to 40%; As, Sb, Cd, Au, and W, in 1 to 10%; and In, Li, Cb, Ge, Be, Pt, Ru, Te, and Y, in less than 1%. Cb occurred in an orthoclase crystal and a sample of schist. Be was found in a weathered granite. Y was found in a sample containing 50% fluorite and 40% quartz. W.D.F.

Tricalcium disilicate (rankinite), a new mineral from Scawt Hill, County Antrim. C. E. TILLEY. *Mineralog. Mag.*, **26** [176] 190–96 (1942).—$3CaO \cdot 2SiO_2$ has been identified for the first time as a mineral in the larnite rocks of Scawt Hill, County Antrim, Ireland. It is associated with wollastonite, larnite, and melilite. The optical properties are as follows: monoclinic, $b = \beta$, α; edge of (001) = 15°; α 1.641, β 1.644, γ 1.650, $2V_\gamma$ 64°, positive. It is named after G. A. Rankin, pioneer in the lime–silica system. L.R.B.

Unreliability of the benzidine color reaction as a test for montmorillonite. J. B. PAGE. *Soil Science*, **51** [2] 133–40 (1941).—The method of Hendricks and Alexander (see "Semiquantitative . . . ," *Ceram. Abs.*, **20** [10] 247 (1941)) for the identification of montmorillonite in the presence of other clay minerals and soil constituents by the blue color reaction of benzidine or its hydrochloride was examined critically. P. found that the presence of montmorillonite was not necessary for the production of the blue color reaction but that with proper oxidizing conditions other mineral types could give the same effect Slightly soluble Fe^{+++}, adsorbed Fe^{+++}, or crystal-lattice Fe^{+++} exposed on broken crystal edges can produce the color. Manganese and other reducible materials in soils were thought to be capable of influencing the color development. P. concludes that the color reaction is indicative merely of the presence of some oxidizing impurity in the material tested. V.D.F.

Unusual occurrence of manganese ore. ROWLAND KING. *Eng. Mining Jour.*, **143** [9] 52–54 (1942).—The Crescent mine is on the Olympic Peninsula, 30 miles west of Port Angeles, Wash. A Jurassic limestone is overlain by a pillow basalt and greenstone. The limestone has been replaced by manganese minerals close to but not in contact with the greenstone. Two or more steps in the replacement are believed to have occurred. The ore mineral here is hausmannite, $Mn_3O_4 \cdot 2H_2O$. Bementite, $8MnO \cdot \cdot 7SiO_2 \cdot 5H_2O$, is found in practically all of the Peninsula manganese deposits. Even the purest bementite is too low in manganese and too high in silica for metallurgical-grade ore. It is not likely, however, that the Crescent mine is the only deposit of hausmannite, but prospecting is difficult because of a rugged terrain and a heavy vegetation cover. The mine is designed to produce 50 to 60 tons of ore per day. W.D.F.

Use of soil-moisture characteristics in soil studies. E. E. CHILDS. *Soil Science*, **50** [4] 239–52 (1940).—The term "soil moisture" is proposed for the relationship be-

tween the moisture content of soil and the pressure deficiency or suction with which the moisture is held. On the basis of moisture-characteristic curves (obtained by the Haines Büchner funnel method) for a number of clay soils, C. finds no justification for a physical system of soil-water classification into gravitational, capillary, and hygroscopic water, etc. A quantitative measure of soil stability is given in terms of the differential curves obtained from soil-moisture characteristic studies on the soil sample in its original condition and again after one cycle of wetting and drying. Each differential curve shows a peak rising a distance h_0 and h_1, respectively, above the main body of the curve. The ratio h_0/h_1 is defined as the numerical value of soil stability. V.D.F.

Vermiculite in the oil industry. ANON. *Chem. Trade Jour.*, **110** [2855] 156 (1942).—Vermiculite is of great value as a drilling mud. Apart from this use, an entire factory in California has been insulated with it, and it is being developed in brick form for the inside of cracking units. L.R.B.

BOOKS AND SEPARATE PUBLICATIONS

Clays. PAUL M. TYLER AND A. LINN. Preprint from U. S. Bur. Mines Minerals Yearbook, Review of 1941. Supt. of Documents, Washington, D. C. 17 pp. Price 5¢. R.A.H.

Evsinsk and Other Places of Origin of Refractory High-Melting Clays of the Novosibirsk Region. F. A. MATVEEVA, G. V. MALKIN, AND V. P. KAZARINOV. Novosib. Oblplan i Obl. n.-i. Kompl. Khim. Lab., 1940. 168 pp Price 8 R. *Khim. Referat. Zhur.*, **4** [2] 32 (1941). M.Ho.

Marketing Strategic Mica. LAWRENCE G. HOUK. *U. S. Bur. Mines Information Circ.*, No. 7219, 24 pp. (1942). Free.—H. discusses the nature of block mica of strategic quality, the detrimental effect of impurities and imperfections, sizes in greatest demand, and other important factors. Regulations and control of federal war agencies, publications, and a glossary of terms used are included. R.A.H.

Modern Methods of Sedimentation Analysis of Suspensions and Emulsions. Determination of Size and Distribution of Particles of Dispersed Systems from the Velocity of Settling. N. A. FIGUROVSKIĬ. Published by the Moscow branch of the Mendeleev Chemical Society, 1940. 173 pp. Price 7 R. *Khim. Referat. Zhur.*, **4** [2] 57 (1941); see "Simple . . . ," *Ceram. Abs.*, **18** [9] 250 (1939). M.Ho.

Pyrometallurgical Studies of Manganese Ores. Smelting of Manganese Oxide, Carbonate, or Silicate Ores with Copper and Iron Sulfides. R. G. KNICKERBOCKER AND VIRGIL MILLER. *U. S. Bur. Mines Repts. Investigations*, No. 3659, 23 pp. (1942). Free. R.A.H.

Stratigraphy of the Pre-Greenhorn Cretaceous Beds of Kansas. NORMAN PLUMMER AND JOHN F. ROMARY. *State Geol. Survey Kansas Bull.*, No. 41 (Part 9), pp. 313–48 (Nov., 1942).—Field work undertaken primarily to determine the occurrence and ceramic properties of clay deposits in the pre-Greenhorn Cretaceous beds of central and north-central Kansas has resulted in much detailed stratigraphic information. The newly acquired data indicate needs for reclassification of these beds. Numerous classifications have been proposed for the Cretaceous rocks of Kansas by various workers during the past 75 years. For the most part, the proposed formations have been either inadequately defined or have been of such nonpersistent nature that they were not useful outside the type area. The proposed classification is as follows: The oldest Cretaceous rocks known in Kansas, which are of continental origin, are classed as the Cheyenne sandstone. Dark marine shale and sandstone above the Cheyenne sandstone are assigned to the Kiowa shale. These two stratigraphic units, named from Kiowa County, Kansas, have been recognized by workers for many years and can be correlated with beds in the north-central Kansas region. Nonmarine clay and sandstone deposits that overlie the Kiowa shale are designated as the Dakota formation. The Dakota is limited upward by the base of the Graneros shale. The formation is subdivided into two members, the Terra Cotta clay member at the bottom and the Janssen clay member at the top. The marine shale above the Dakota formation and below the Greenhorn limestone is classified as the Graneros shale. The continental or nearshore Cheyenne sandstone is thought to represent deposits made near the strand line of the northward-advancing Cretaceous sea. The Kiowa shale was deposited in a relatively shallow sea. The Dakota formation comprises clay and sand deposited on flats not far above sea level. Deposition of the Dakota beds was terminated by a readvance of the sea, and in this sea the marine shale and sandstone of the Graneros formation accumulated. 6 figures.

PATENTS

Concentration of kyanite. F. X. TARTARON (Phosphate Recovery Corp.). U. S. 2,305,502, Dec. 15, 1942 (April 9, 1941).—A process of concentrating kyanite from its ores which comprises comminuting the ore to suitable particle size, pretreating the comminuted ore by agitating it in a pulp containing sulfuric acid, washing the sulfuric acid away from the ore, agitating the thus acid-treated and washed ore in a pulp containing a higher fatty acid, and subjecting the thus-conditioned pulp of kyanite ore to froth flotation to separate a concentrate of kyanite.

Making clay fillers. W. F. BROWN (Champion Paper and Fibre Co.). U. S. 2,305,404, Dec. 15, 1942 (Sept. 8, 1939).

Treating iron-bearing feldspathic minerals. R. W. LAWSON AND W. F. DENEEN. U. S. 2,306,171, Dec. 22, 1942 (July 17, 1941).—The process of treating iron-bearing feldspathic minerals to remove excessive iron which comprises heating the mineral to a temperature which renders it readily friable, crushing and sizing the mineral, removing the fines, subjecting the sized fragments to magnetic separation, agglomerating and heating the fines, subjecting the material thereof to magnetic separation, and recovering its feldspathic values.

Treating mineral materials. R. L. KNOWLES, R. W. FRISCHMUTH, AND H. S. COLTON (Thompson Silica Co.). U. S. 2,306,021, Dec. 22, 1942 (June 6, 1940).—The process of removing iron oxide from natural silicon dioxide sand which includes converting the iron oxide into a soluble iron salt by the action of an acid solution containing approximately 10% sulfuric acid and 10% sodium chloride and containing a wetting agent, accelerating the reaction by the application of heat to the sand and acid solution, separating the sand and solution, and washing out the sand in water.

Treating the rock, aplite, and making ceramic ware. R. F. BRENNER AND R. D. DUBBLE (Dominion Minerals, Inc.). U. S. 2,304,440, Dec. 8, 1942 (Dec. 5, 1940).—A process for reducing the iron content of aplite which comprises calcining aplite containing iron compounds at a temperature of 1000° to 2500°F. for a time sufficient to render the iron content soluble in acids and then leaching the aplite with an acid for a time sufficient to dissolve a major portion of the iron content, while leaving the greater part of the original alumina content unattacked.

Chemistry and Physics

Action of alkalis on blast-furnace slag. A. O. PURDON. *Jour. Soc. Chem. Ind.* [London], **59** [9] 191–202 (1940).—Blast-furnace slag, rapidly chilled by water quenching and ground, will set, but the time required is greatly reduced by accelerators. Alkalis were studied for this purpose. Maximum strength is attained with 5 to 8% NaOH in the mixing water. The NaOH may be replaced by equivalent quantities of lime plus a sodium salt, such as NaCl (from sea water if convenient), Na_2CO_3, Na_2SO_4, etc. With such a quantity of alkali, the properties of the blast-furnace slag cement were compared with those of (1) Portland, (2) Portland + slag, (3) rapid-hardening Port-

land, and (4) aluminous cements. The blast-furnace slag cement has the advantages of (1) high early strength, (2) low heat of hydration, (3) water-tightness in the form of concrete, and (4) low solubility in aggressive waters. Its disadvantages are as follows: (1) Alkalis, hygroscopic and quickly carbonated, cannot be incorporated with the slag but must be put in the mixing water. (2) If lime plus alkali salt is put in the dry cement, the quantity must be varied to suit the consistency of the mix. (3) Such a cement will not keep. The process is suitable, therefore, only for large users, ready-mixed cement distributors, and makers of precast cements. L.R.B.

Application of phase analysis in industry. V. A. ROMASHCHENKO. *Zavodskaya Lab.*, **9** [9] 1030–32 (1940); *Khim. Referat. Zhur.*, **4** [3] 59 (1941).—R. used centrifuging to determine the insoluble residue in dolomites and limestones. A 3-gm. ground sample is dried for 5 min. at 180° and then ignited for 20 min. at 750° in the presence of an oxidizing agent to decompose the organic substances. The sample is dissolved in 1:1 HCl and transferred to a centrifuging burette. The burette has the shape of a cone, the bottom being a graduated capillary. To facilitate the removal of the solids from the capillary, a hole is made in the lower part. The hole is covered with a metal foil having a rubber lining which is held in place with the aid of a sleeve and a bolt and nut assembly. The sample is centrifuged for 3 min. at 1800 to 2000 r.p.m. The solids in the capillary are stirred up with a glass rod and again centrifuged. The height of the solids in the capillary is then noted. For the calculations it is necessary to know the weight of 1 mm. of the sediment. This is determined by taking the average of several calibrations. The accuracy is within 0.2%. The determination takes 35 min. M.Ho.

Basic principles involved in the preparation of pigments. R. H. SAWYER. *Jour. Applied Physics*, **13** [10] 596–601 (1942).—Pigments provide the color, opacity, and light-diffusing properties of most surface coatings and of many other articles of commerce. These optical properties, paramount in the preparation and use, depend on the refractive index and light absorption of the pigment material and on the particle size in which the material is supplied. The basic relations are reviewed. In practical pigmented systems particles are close together or in contact, and mutual effects must also be considered. Pigments of high hiding power must have a high refractive index. White pigments must be transparent as massive materials, while colors must have intense and highly selective absorption. The manufacture of a pigment from a suitable base material is a problem in particle-size control. Highest hiding power is obtained at a critical particle size of approximately the wave length of light. A.P.

Construction of alignment charts. W. C. SEALEY. *Power Plant Eng.*, **46** [9] 82–84; [10] 73–74 (1942).—Equations with three unknowns which can be written so that no term contains more than one variable can be plotted as three parallel straight lines on an alignment chart. S. gives ten rules for deriving the alignment chart from the original equation and shows by an example how they are applied. Other equations with three unknowns which cannot satisfy the previous rules can sometimes be put into a form which can be put on an alignment chart as nonparallel straight lines or curves. Five rules are given to show how this is done. W.D.F.

Darkening of materials by light. F. SEITZ. *Jour. Applied Physics*, **13** [10] 639–43 (1942).—Since both crystals and glasses are built from atoms, they possess many properties in common, such as the phenomenon of photolysis, or darkening by light. S. summarizes from an atomic standpoint the basic principles that govern photolysis. In most cases the process falls into a fixed pattern. Certain electrons are excited by absorption of radiation, and secondary processes allow them to remain in an excited state where they absorb new wave lengths in the visible part of the spectrum and discolor the material. A.P.

Equilibrium relationships on the liquidus surface in part of the MnO–Al_2O_3–SiO_2 system. R. B. SNOW. *Jour. Amer. Ceram. Soc.*, **26** [1] 11–20 (1943).—6 figures, 9 references.

Further phase-equilibrium studies involving the potash compounds of Portland cement. WILLIAM C. TAYLOR. *Jour. Research Nat. Bur. Standards*, **29** [6] 437–51 (1942); RP 1512. Price 10¢.—The present research on the system $K_2O \cdot 23CaO \cdot 12SiO_2$–$CaO$–$5CaO \cdot 3Al_2O_3$ is a part of the program designed to determine the manner in which K_2O affects the compound composition of Portland-cement clinker. Thermal and optical data are presented, and a phase-equilibrium diagram of this system has been constructed. The only compounds that were observed in the system under equilibrium conditions are the components of the system and $3CaO \cdot Al_2O_3$. The effect of K_2O on the compound composition of clinker containing K_2O, CaO, MgO, Al_2O_3, Fe_2O_3, SiO_2, and SO_3 was also studied. The only compounds of K_2O found to be stable are K_2SO_4 and $K_2O \cdot 23CaO \cdot 12SiO_2$, the K_2O combining preferentially with the SO_3 present. See "System . . .," *Ceram. Abs.*, **20** [11] 274 (1941). R.A.H.

Impact strength of transparent and translucent fused silica and recrystallized alumina. BURROWS MOORE. *Jour. Soc. Chem. Ind.* [London], **59** [6] 119–20 (1940).—The impact strength of cubes of fused silica and recrystallized alumina of about $^1/_8$-cu. in. volume was measured by allowing a weight to drop from a predetermined height on the cube resting on a plate. The upper and lower faces of the cube and the lower surface of the falling weight were all plane and parallel. The impact strength was calculated from $f = \sqrt{(2EWh/V)}$, where E is Young's modulus for the material, W is the weight of the falling load, h is the height of fall, and B is the volume of the specimen in units corresponding to the units in which f is measured. The impact strength of transparent fused silica is only slightly higher than that of translucent fused silica, and the impact strength of recrystallized alumina formed by slip-casting is about the same as that of recrystallized alumina formed by extrusion through a die. The values for silica and alumina were about 12,000 and 43,000 lb. per sq. in., respectively. L.R.B.

Measurements of workability of ceramic bodies for plastic molding processes. E. C. HENRY. *Jour. Amer. Ceram. Soc.*, **26** [1] 37–39 (1943).—2 figures, 3 references. See *Ceram. Abs.*, **21** [6] 129 (1942).

Newton's rings, the yardstick of optical science. RUDOLPH MILLER. *Bausch & Lomb Mag.*, **18** [3] 18 (1942).—The testing of optical surfaces is accomplished by observing the color phenomena emanating from thin wedges of air between two glass surfaces in contact; rings appear as the result of the interference of light rays as they are reflected from the under surface (the lag must be $^1/_2$ wave length). M. discusses both the corpuscular theory and the modern wave theory in regard to the explanation of Newton's rings. R.H.B.

Precision in spectrochemical analysis. H. B. VINCENT AND R. A. SAWYER. *Jour. Optical Soc. Amer.*, **32**, 686–92 (1942).—Statistical methods are applied to the study of spectrochemical data to focus attention on those operations whose contributions to the total error are significant. A.P.

Qualitative tests for bismuth with quinoline. I. P. RYAZANOV AND A. V. CHEKALINA. *Uchenye Zapiski Saratov. Gosudarst. Univ.*, **15** [4] 134–36 (1940); *Khim. Referat. Zhur.*, **4** [3] 54 (1941).—The authors describe qualitative tests for Bi which consist in forming a $KBiI_4$ which gives an orange-red precipitate with quinoline, $[C_9H_8N]$ $[BiI_4]$. To 1 ml. of the unknown, a solution of KI is added until the precipitate BiI_3 disappears, and then a HNO_3 solution of quinoline is added dropwise. Best results are obtained when the solutions of KI and the Bi salt are equivalent. The interfering ions, Pb, Ag, and Hg, are previously removed with a saturated solution of NaCl. Cu and Fe, which also interfere, are transformed into pyrophosphate complexes by the addition of a solution of $Na_4P_2O_7$. The proportions in which the interfering ions may be present and in which Bi can still be determined are Bi:Pb:Hg:Cu:Ag:Fe = 1:143:14.3:0.6:78:27. M.Ho.

Rapid method for determining P_2O_5 with the aid of the hydrostatic balance of N. A. Figurovskiĭ. G. A. MARKOVA

AND A. G. FILIPPOVA. *Zavodskaya Lab.*, 9 [8] 831–35 (1940); *Khim. Referat. Zhur.*, 4 [3] 49 (1941).—The authors perfected the Figurovskiĭ balance (*Zavodskaya Lab.*, 6 [3] 355 (1937); ("Simple . . .," *Ceram. Abs.*, 18 [9] 250 (1939)). They determined P_2O_5 with this balance and with the citrate method of Nissens. In determining P_2O_5, different ammonium molybdate reagents give different precipitates. Similar precipitates can be obtained by increasing the amount of added HNO_3 to 15 ml. The time of shaking of the phosphomolybdate precipitate may be decreased to 5 min. On the basis of a large number of experiments, this rapid method was considered to be as valuable as the Nissens method. M.Ho.

Rapid method of determining silica in silumin. KH. I. TSIBULEVSKIĬ. *Zavodskaya Lab.*, 9 [9] 1037–38 (1940); *Khim. Referat. Zhur.*, 4 [3] 54 (1941).—The silumin is decomposed with acids instead of by the usual alkali decomposition, and the dehydration of SiO_2 is eliminated. Decompose 1 gm. of silumin with a mixture of 35 ml. of $1.2HNO_3$ and 3 ml. of 1.19HCl. Evaporate to 10 ml., dilute with water, boil, and filter. The residue contains Si and SiO_2; ignite it to constant weight and treat with HF as usual. The difference in weight gives SiO_2. Wet the residue with a little water and add H_2SO_4, HF, and $1.4HNO_3$ dropwise to complete the oxidation of Si and until the solution becomes clear. Concentrate and ignite to constant weight as before. The difference in weight is Si. To the combined value of Si add an empirical correction of 0.20% for the SiO_2 lost in the filtrate. M.Ho.

Rapid microdetermination of boron by means of quinalizarin and a photoelectric colorimeter. L. C. OLSON AND E. E. DE TURK. *Soil Science*, 50 [4] 257–64 (1940).—The adaptability of the photoelectric colorimeter and the effects of temperature, acid concentration, and time of standing were investigated in connection with the microdetermination of boron in soils and plants by means of quinalizarin. V.D.F.

Significance of stray light in photoelectric filter photometers. M. N. STATES AND J. C. ANDERSON. *Jour. Optical Soc. Amer.*, 32, 659–66 (1942).—During the last decade, filter photometers have been extensively used for routine chemical analyses. A single operator can make 120 tests in 8 hr. Analytical curves obtained on filter photometers are in general nonlinear, i.e, the concentration vs. log transmittancy plot is concave upward. Stray light effects can only be estimated, and the instrument should therefore be calibrated for a number of concentrations. Effects of selective fatigue of the photocell must also be eliminated by appropriate instrument design. A.P.

Silicosuperphosphate. ANON. *Chem. Trade Jour.*, 110 [2854] 134 (1942).—One part of ground serpentine reacts with 3 parts of newly made superphosphate to give "serpentine superphosphate" or "silicophosphate." It contains the magnesium and silica in a more active state than in the parent substance. The active silica is said to be an aid to plant growth. L.R.B.

Simplified method of testing for K^+, Na^+, NH_4^+, and Mg^{++} in the presence of each other. S. L. ARKHANGELOVA AND V. N. ARKHANGELOV. *Trudy Stalingrad. Med. Inst.*, 4, 137–46 (1940); *Khim. Referat. Zhur.*, 4 [3] 50 (1941).—The simplification consists in boiling the unknown solution made alkaline instead of igniting it to remove the NH_4 salts. The formation of a precipitate on the addition of a base indicates Mg. After NH_4 and Mg are filtered off, K is determined with hexacobaltinitrite or with acid potassium tartrate. Na is determined with K pyroantimonate. M.Ho.

Spectrochemical determination of silicon, iron, and aluminum in mineral powders with a high-voltage direct-current arc. H. I. OSHRY, J. W. BALLARD, AND H. H. SCHRENK. *Jour. Optical Soc. Amer.*, 32, 672–80 (1942).—Silicon, iron, and aluminum are determined as the oxides in powder samples, using less than 12 mgm. of sample and concentrations between 1 and 100%. The sample is diluted in a known amount of nickel oxide with graphite powder. A full-wave rectified 2200-v. arc has been found suitable for the complete volatilization of mineral samples and should have further application in the analysis of refractory materials. The technique has been tested with analyzed samples and is being extended to cover other elements. One analyst can determine at least the three components in $1^1/_2$ hr. A.P.

System B_2O_3–BeO–Li_2O in its glasslike state (transparent glasses for X rays). L. YA. MAZELEV. *Zhur. Priklad. Khim.*, 13 [9] 1288–1303 (1940); *Khim. Referat. Zhur.*, 4 [5] 29 (1941).—M. investigated the softening temperature, specific gravity, solubility in water, coefficient of thermal expansion, index of refraction, crystallization, and X-ray transparency (for soft rays) of B–Be–Li glass found in the ternary diagram B_2O_3–BeO–Li_2O in the region B_2O_3 70 to 90, BeO 3 to 15, and Li_2O 6 to 24%. He established the limits of transparent, noncrystallizing glass. A comparative study of various glasses showed that the compositions BeO 14.08 + Li_2O 17.56 + B_2O_3 68.36% and BeO 11.95 + Li_2O 17.82 + B_2O_3 70.23% are superior to the Lindemann glass in resistance to crystallization, moisture, and coefficient of linear expansion. The latter is similar to that of glass No. 23 of Druzhnaya Gorka and is of great practical importance in the preparation of X-ray tubes. The coefficient of absorption of X rays is somewhat higher in these glasses, however, than in the Lindemann glass. M.Ho.

Testing for barium, strontium, calcium, and lead. A. T. PILIPENKO. *Zavodskaya Lab.*, 9 [9] 1034–35 (1940); *Khim. Referat. Zhur.*, 4 [3] 52 (1941).—Boil the unknown neutral solution with Zn dust. Filter off the sediment and dissolve in HNO_3. Pb is determined as sulfate. In the filtrate, Ba is determined as chromate. After the $BaCrO_4$ is filtered off, Sr is determined as sulfate. For determining Ca, the Ba and Sr are removed as sulfates, and the Ca in the filtrate is determined as oxalate. The sensitivity of these tests is Pb 0.2, Ba 0.12, Ca 0.16, and Sr 0.32 gm. per liter. M.Ho.

Use of glass diaphragms for measuring the decomposition potential of fused salts. N. G. CHOVNIK AND D. S. PEL'KIS. *Zhur. Obshcheĭ Khim.*, 10 [16] 1443–48 (1940); *Khim. Referat. Zhur.*, 4 [4] 21–22 (1941).—The authors determined the decomposition potentials of fused mixed salts of $PbCl_2$-NaCl and $PbCl_2$-KCl at 420° to 620°. The measurements were made by determining the I–V curves with graphite electrodes; platinum electrodes gave smaller potentials because of the interaction of the Pt anode with Cl. A thin glass diaphragm was used to separate the anode and the cathode compartments, thereby inhibiting the depolarization of electrodes by the products of electrolysis. The magnitudes of the potentials obtained with the diaphragms differed only slightly from the electromotive force of the corresponding reversible reactions, which indicates their reliability. Furthermore, the I–V curves obtained with the diaphragms are distinguished by the presence of sharp breaks. This enables accurate extrapolation to determine the decomposition potentials. The use of glass diaphragms can be recommended for the determination of decomposition potentials of fused electrolytes containing Na or K ions. M.Ho.

X-ray investigation of synthetic amphibole prepared from fused pyroxene. D. P. GRIGOR'EV AND V. N. DUBININA. *Zapiski Vserossiĭskogo Mineral. Obshchestva*, 69 [2–3] 217–20 (1940); *Khim. Referat. Zhur.*, 4 [4] 33 (1941).—Synthetic amphibole produced by fusing pyroxene with additions of F is not a monomineral compound as it appeared from optical data. The product consists of two crystalline phases: amphibole of the tremolite type and fluorite (over 16.5%). The synthetic amphibole has the chemical composition $F_2Ca_2Mg_5Si_8O_{22}\cdot 0.14F_2Ca_7Si_8O_{22}$. See "Synthetic . . .," *Ceram. Abs.*, 21 [2] 50 (1942). M.Ho.

BOOK

Optical Methods of Chemical Analysis. T. R. P. GIBB, JR. McGraw-Hill Book Co., New York, 1942. xiv + 391 pp., 300 figs. Price $5.00. Reviewed in *Jour. Optical Soc. Amer.*, 32, 696 (1942). A.P.

PATENTS

Ceramic pigment. C. G. GEARY (E. I. du Pont de Nemours & Co.). U. S. 2,304,750, Dec. 8, 1942 (July 12, 1940).—An improved black ceramic pigment suitable for use as a graining pigment which comprises an iron-chrome-cobalt black ceramic pigment and zinc sulfide, the zinc sulfide being present in amounts not exceeding 10% by weight based on the total weight of the graining pigment.

Improving the brilliance and color of titanium dioxide. R. H. MONK (American Zinc, Lead & Smelting Co.). U. S. 2,304,947, Dec. 15, 1942 (Dec. 4, 1939).—The process which consists in mixing at least one oxide of that group of elements consisting of aluminum, gallium, indium, silicon, germanium, and tin with at least one oxide of that group of metals consisting of beryllium, magnesium, calcium, strontium, barium, and zinc, the oxide or oxides in the mixture taken from the latter group being in stoichiometric excess of the oxide or oxides in the mixture taken from the first-mentioned group, the excess being calculated upon the normal spinel compounds of equal combining weights of all the oxides in the mixture, adding the mixture to uncalcined TiO_2 containing colored impurities in an amount equal to not more than 5% of the TiO_2, and then calcining the mixture.

Manufacture of improved titanium dioxide pigments. R. K. WHITTEN (E. I. du Pont de Nemours & Co.). U. S. 2,305,368, Dec. 15, 1942 (March 31, 1939).—A process for removing impurities from titanium oxide pigments which comprises mixing precipitated, purified titanium dioxide recovered from titanium solution hydrolysis and containing adsorbed chromium and vanadium compound impurities with sufficient sulfuric acid to produce a filterable, substantially nonhydrolyzable TiO_2 suspension containing a total of H_2SO_4 concentration ranging from about 75 to about 550 gm. per liter, digesting the resulting suspension at an elevated temperature ranging from about 80°C. to the boiling point for such period of time that the impurities are substantially removed from the TiO_2 and not to exceed about 15% of the TiO_2 becomes dissolved in the process, and then recovering and calcining the resulting purified TiO_2 product.

Manufacture of sodium perborate. E. I. DU PONT DE NEMOURS & CO. AND H. N. GILBERT. Brit. 549,298, Nov. 25, 1942 (May 12, 1941).

Manufacture of titanium pigments. BRITISH TITAN PRODUCTS CO., LTD., AND R. W. ANCRUM. Brit. 549,120, Nov. 18, 1942 (July 3, 1941).

Preparation of artificial cryolite. JOSEF ERINGER (vested in the Alien Property Custodian). U. S. 2,305,921, Dec. 22, 1942 (Aug. 8, 1939).—A process for the manufacture of pure silica-free artificial cryolite from silica-containing reactants comprising reacting an equivalent mixture of dry aluminum fluoride and alkali-metal silicofluoride at a temperature of between about 450° and about 500°C.

Zinc oxide. H. M. CYR (New Jersey Zinc Co.). U. S. 2,303,329, Dec. 1, 1942 (July 6, 1940).—In the treatment of finely divided zinc oxide having an acidity in excess of 0.2% the improvement which comprises exposing the zinc oxide to contact with steam until the acidity of the zinc oxide is substantially below 0.2% and to propionic acid in proportions ranging from about 0.1 to 0.6% to form zinc propionate on the surfaces of the zinc oxide particles.

Zinc oxide. B. R. SILVER AND E. R. BRIDGWATER (New Jersey Zinc Co. and E. I. du Pont de Nemours & Co.). U. S. 2,303,330, Dec. 1, 1942 (Feb. 2, 1942).—Finely divided zinc oxide, the particles of which are coated with zinc propionate.

General

Accident, saboteur of man power. ANON. *Bull. Amer. Ceram. Soc.*, **22** [1] 27–28 (1943).

Are you color blind? ROBERT COURNEEN. *Eyesight* (Bausch & Lomb Optical Co.), **4** [2] 8 (1942).—John Dalton's paper, "Extraordinary facts relating to the vision of colours," is the world's first scientific exposition that delves into the psychological and physical problem of color blindness. Color vision may be classified as follows: (1) Trichromatic vision is normal vision where the three primary colors, red, green, and blue, acting individually or collectively, afford perception of the almost infinite variety of colors, hues, and shades of gray discernible by man; (2) Dichromatic vision is the function of two primary colors. An individual is red-green or yellow-blue blind, depending upon which of the primary sensations (red, blue, or green) is absent; (3) Monochromatic vision is total color blindness; the individual is conscious of only blacks, whites, and shades of gray. To detect color blindness, several tests are employed. The Seebeck test consists of matching 300 pieces of colored paper, glass, and cloth. The Holmgren test requires the patient to match skeins of Berlin wools with selected skeins. The spectrum test consists in showing a portion of one spectrum to the individual and having him pick it out in a full spectrum. The Ishihara test uses a series of colored mosaics, circles about $3\frac{1}{2}$ in. in diameter, composed of numerous dots of various sizes and hues; the colored dots are arranged in definite designs so that the normal person will be able to read one number in the circle, while the color-blind person will read another. It is now known that color blindness is congenital; it is transmitted through the female according to a pattern of recessive inheritance. The two most prominent theories of color vision are as follows: (1) The Young-Helmholtz theory hypothecates that there are three different types of cones in the retina sending visual impulses to the brain; each cone type responds to one of the three primary colors. (2) The Hering theory contends that there are three photochemical substances in the retina; these substances are designated as red-green, yellow-blue, and white-black compounds which are subject to chemical changes of a constructive and destructive nature. R.H.B.

Base-exchange water treatment. D. BROWNLIE. *Steam Engr.*, **11** [123] 62–64, 67 (1941).—The nature of hard water, zeolites, and base-exchange phenomena are discussed. The agencies in the water which may injure the zeolite are considered, and reference is made to four commercial (British) types of boiler feed-water softeners. The function of carbonaceous zeolites, made from coal, etc., which replace the metal cations with H ions, is described. As this type can also separately remove the anions, the aqueous product competes with distilled water. L.R.B.

Control of gas-heated furnaces. H. A. FELLS. *Gas World* [Ind. Gas Supp.], **9** [1] 9–11 (1937).—An account is given of the design and operation of a double-muffle type controlled-atmosphere furnace for hardening high-speed steel. Some of the heating gases from the high-temperature chamber are dehydrated to a water content of 2% by water-cooling and passed back to the muffles. L.R.B.

Control of heat economy in ceramic plants. FRIEDRICH LIPINSKI. *Keram. Rundschau*, **46** [8] 79–81 (1938).—Suggestions are given for determining the total quantity of heat introduced into the drier and the furnace, the actual amount of heat needed for drying or firing a given quantity of ware, the purpose for which the heat is used in each case, and the sources of heat loss. M.V.C.

Control of power economy in ceramic plants. FRIEDRICH LIPINSKI. *Keram. Rundschau*, **46** [6] 57–60 (1938).—The total power consumption of a porcelain factory and the power used by each machine in the factory during one week are shown in tables and curves. The operating efficiency of the steam engine and boilerhouse where the power is generated can be checked by determining the quantity of (1) fuel consumed and its calorific value, (2) steam generated and its heat value, (3) fuel gases and their calorific value per unit of measurement by means of a thermometer and an instrument for determining the CO and CO_2 content, and (4) ash and slag and their heat

value. The power consumption for the different branches of production is presented graphically. This record aids in controlling the power economy in ceramic plants. M.V.C.

Control and statistical data in ceramic plants. FRIEDRICH LIPINSKI. *Keram. Rundschau*, **46** [11] 117–20 (1938).—Data on the weekly consumption of raw materials, power and heat used, working hours, etc., per unit of finished ware serve not only as a basis for cost calculation but also as a control or check on the efficiency of production for the entire plant and for each branch; they also indicate what departments can be improved and by what means. The reading of operational statistics and the use of comparison data must be learned, and examples and illustrations are given. These data can be used for reference and for finding the cause of unexpected increases in costs, etc. See "Production . . .," *Ceram. Abs.*, **22** [1] 13 (1943). M.V.C.

Critical materials: their conservation by use of alternates. JOHN HORN. *Gen. Elec. Rev.*, **45** [7] 407–14 (1942).—The latest compilation of the relative availability of materials, issued by the Conservation and Substitution Branch of the WPB, shows the following 15 materials in the group of about 67 materials which are designated as those most vitally needed for war purposes and hence not generally available for other needs: alloy steel, aluminum, chromium, copper, magnesium, nickel, tin, tungsten, formaldehyde, phenol-formaldehyde resins and plastics, shellac, toluol, tung oil, mica splittings, and rubber. Many examples are given showing how substitutions have been made. Illustrated. L.E.T.

Demand and supply of ceramic engineering graduates. ARTHUR S. WATTS. *Bull. Amer. Ceram. Soc.*, **22** [1] 16 (1943).

Dust problems in the ceramic industry: I. LEONARD GREENBURG AND THEODORE HATCH. *N. Y. State Dept. Labor Div. Ind. Hyg. Bull.*, **21** [April] 147–50 (1942); abstracted in *Jour. Ind. Hyg. & Toxicol.*, **24** [7] 141 (1942).—A general survey of the dust problem in 21 ceramic plants in New York, together with a detailed study of the dust control in 9 plants, was the basis for this report. The industries also supplied dust-concentration data. Procedures for unloading, storing, and handling raw materials are given and are tabulated for 18 separate processes in regard to the dust involved and the control measures indicated or lacking. The raw materials required include flint, feldspar, clay, and smaller amounts of other substances. Free silica percentages in relation to flint are given for all materials listed. Potteries possess more dust-producing operations than other industries. Potentially dusty operations involving silicosis and pneumoconiosis hazards and lead poisoning are listed. **II.** *N. Y. State Dept. Labor Div. Ind. Hyg. Bull.*, **21** [May] 186–87 (1942); abstracted in *Jour. Ind. Hyg. & Toxicol.*, **24** [8] 162 (1942).—Crushing, grinding, and screening operations have been controlled by enclosing them and providing local exhaust ventilation. **III.** *N. Y. State Dept. Labor Div. Ind. Hyg. Bull.*, **21** [June] 232–35 (1942).—An extensive summary of findings is given, and recommendations previously formulated by the U. S. Public Health Service for potteries are regrouped for ready reference. K.R.

Glass industry enlists in war on accidents. R. L. CLAUSE. *Glass Ind.*, **23** [12] 468 (1942).—The glass industry's frequency rate for accidents is one-half the average for all industry, and its severity rate is one-third the average. Between 1929 and 1940 the glass industry experienced reductions of 43% in frequency and 46% in severity. All industry increased in frequency 8% under the war conditions of 1940 to 1941, while the glass industry increased only 3%. Severity-rate reductions have been recorded in both large and small organizations. The glass industry is fourth in a list of 31 major American industries. The National Safety Council and industry have formed a War Production Fund to Conserve Manpower to make possible the unprecedented increase in supervisory, consultant, and educational activity which accident prevention on a wartime scale entails. See "Accident . . . ," this issue, p. 43. A.P.

Law and custom. F. W. PRESTON. *Glass Ind.*, **23** [12] 463–64 (1942).—The Toledo Court decision in the glass container industry case introduces industrial and technological problems and has social and sociological aspects, which P. discusses. A.P.

Mill drying of coal. M. E. FITZE. *Trans. Amer. Soc. Mech. Engrs.*, **63** [4] 273–76 (1941).—The drying of coal in the mill while grinding, instead of in separate driers previous to mill operations, makes possible large savings in equipment, building, and operating costs and a net gain in boiler-plant efficiency of about 0.5%. This gain is due to improvement in air-heater performance, resulting from less gas flow through it, as well as the reduction of approximately 6% of the total gas to 150°F. instead of the usual 350°F. Use of an auxiliary cyclone in the mill-vent circuit, with return of the coal separated therefrom to the mill, results in a coal loss from the system of only about 0.25%. Illustrated. F.G.H.

Minnesota dust counter. ANON. *Engineering*, **154** [4010] 401–404 (1942).—The importance of air-borne dusts in relation to occupational diseases such as silicosis and to refined technical processes in industry is discussed. Various types of dust counters are reviewed, and the Minnesota type dust counter is compared with the Smith-Greenburg and the Bausch & Lomb counters. As impingement-type dust counters depend on the mass inertia of the particles, it is reasonable to expect some selectivity in respect to both particle size and density. If such is the case, selectivity errors should be smaller in the Minnesota counter than in the other two instruments. Illustrated. G.A.K.

Nonmetallic materials as a substitute for nonferrous metals and alloys. I. YA. KLINOV. *Vestnik Inzhenerov & Tekh.*, **1940**, No. 9, pp. 528–32; *Khim. Referat. Zhur.*, **4** [4] 103–104 (1941).—K. describes the properties of materials suitable for replacing nonferrous metals, e.g., ceramic products, fused diabase, fused quartz, glass, bonding materials, plastics, wood, etc. Directions are given for the development of such materials. See *Ceram. Abs.*, **21** [7] 157 (1942). M.Ho.

Particulars of design and operation of twin-furnace boilers. JOHN BLIZARD AND A. C. FOSTER. *Trans. Amer. Soc. Mech. Engrs.*, **63** [6] 505–12 (1941).—The advantages of a boiler with two furnaces instead of one include a lower furnace exit-gas temperature for the same rate of heat liberation per unit of furnace volume. When a radiant superheater is installed in one of the furnaces, the final temperature of the steam may be controlled over a wide range of steaming by suitable adjustment of the rate of firing in both furnaces. A boiler generating 750,000 lb. of steam per hr. with two furnaces, fitted with both radiant and convection superheaters, is described, and particulars of its operation are given. Other two-furnace boilers provided with radiant superheaters are illustrated and described. F.G.H.

Patent law: I, Chemical patents. J. G. FIFE. Presented at meeting of London Section, British Assn. of Chemists, March, 1942; abstracted in *Chem. Trade Jour.*, **110** [2863] 343–44 (1942).—Difficult aspects of British patent law are considered, in particular "selection patents," the position of an inventor-employee, patents taken out by large firms based closely on the published work of others, and invalid patents. F. estimates that 80% of British patents granted are invalid, chiefly on the grounds of lack of subject matter and lack of utility. He believes that British Patent Office officials should have further powers to eliminate these. **II, Patent law and practice.** *Ibid.*, [2864] 380–82.—The duties of the Patent Office examiner are considered with particular reference to the points of patent law upon which the examiner may base his objections to granting a patent. L.R.B.

Production of stone, clay, and glass products. LEWIS B. HERSHEY. *Selective Service System Occupational Bull.*, No. 34; reprinted in *Bull. Amer. Ceram. Soc.*, **22** [1] 15 (1943).

Professional man power for the war. H. A. BARTON. *Jour. Applied Physics*, **13**, 415–17 (1942).—B. outlines

under ten headings the job faced by a national man-power commission in allocating highly professional men. A.P.

Recent developments in burning Midwestern coals on water-cooled underfeed stokers. H. C. CARROLL. *Trans. Amer. Soc. Mech. Engrs.*, **63** [3] 183–90 (1941).—There is an increasing trend toward one-boiler-unit operation in a single plant, due to a better understanding of boiler and furnace design, feed-water treatment, heat-recovery devices, and fuel-burning equipment, which tends to promote increased efficiency, greater ease of operation, and greater reliability. C. believes that the application of water cooling to underfeed stokers will prove fully as beneficial in protecting the grate structure of the stoker as it has in the protection of refractory furnace walls. The complications involved are outlined, and numerous successful installations using Midwestern coals are described. Illustrated. F.G.H.

Refraction of the eye. ANON. *Eyesight* (Bausch & Lomb Optical Co.), **4** [2] 10 (1942).—The functioning of the eye is described with the purpose of showing how fatigue and unnatural muscular exercise are related to eye defects. The transparent cornea of the eye has a curved surface which refracts the rays of light so that they pass through the pupil and reach the crystalline lens which is very transparent and curved on both front and back surfaces. The lens is composed of an elastic substance which may be dilated or compressed according to muscular action; this flexibility of focusing is termed "accommodation." The process of automatic adjustment is called reflex action. The iris of the eye systematically adjusts the size of the pupil, by reflex action, to suit the intensity of the light reaching the retina. The eye is responsible for se se impressions of length and breadth, while depth is supplied largely from memory. The mind fuses the images from the two retinas into one image. Light-ray diagrams portray various eye maladies. R.H.B.

Role of the American Ceramic Society in ceramic standardization: What the American Ceramic Society can and should do in the field of standardization. ARTHUR S. WATTS. *Bull. Amer. Ceram. Soc.*, **22** [1] 5–6 (1943). **Statements.** JOHN D. SULLIVAN, FREDERICK HEATH, JR., AND J. W. WHITTEMORE. *Ibid.*, pp. 6–7. **Discussion.** A. S. WATTS ET AL. *Ibid.*, pp. 7–8.

Science of camouflage. E. M. POOL. *Gas Jour.*, **232**, 110–13 (1940).—Devices used to make factory buildings, storage tanks, gas holders, etc., less readily discernible from the air include (1) distortion of the shape by netting or temporary erections fixed on scaffolding, (2) breaking up of the outline into smaller sections, more brightly painted, to which the eye is drawn, (3) the use of mat paints, especially those to which noncrystalline grit is added, to reduce difference in tone of, e.g., two sides of a roof of the same color, and (4) the attachment of large balls of steel wool dipped in various colored paints. Pigments should be neutral not only to the eye of the aerial observer but also to the infrared photographic plate. It is essential to plan, correct, and test the camouflage scheme by actual inspection from the air, flying from the four points of the compass. L.R.B.

Silica-free dust. L. G. RIGLER. *Minnesota Med.*, **25**, 746 (Sept., 1942).—The relation of occupation to tuberculosis may concern its discovery by survey methods among large groups of workers or its development in an individual worker as a result of the work he is doing. The principal factor is dust inhalation, but unless the dusty atmosphere contains substantial amounts of free silica, noxious gases, or poisonous metals, the worker will not develop a new tubercular infection or reactivate an old one. Inquiries have been common about possible dust dangers in cement plants, flour mills, sawmills, and other dusty plants. Uncomfortable as such workplaces may be, there is no evidence indicating that permanent effects result from such occupational dusts. The degree of fibrosis caused by them is minimal, and the incidence of tuberculosis among the workers is no greater than among the rest of the population. In occupations producing large quantities of free-silica dust, however, the lung fibrosis from certain types and quantities of siliceous dusts (commonly called silicosis) has been ascertained to increase the tendency to develop tuberculosis. This is true, whether the worker acquires silicosis in the granite quarries of Barre, Vermont, where the tuberculosis incidence is 130 times that of the remaining population, or in marble quarries, metal mines, or many other occupations in which the worker is exposed to free-silica dust. Numerous other factors must be studied: the concentration of the silica, the character of the dust, the size of particles, the length of exposure, and the presence of carriers of tuberculosis in the group. Only by such studies can the presence of silicosis and its effect in increasing the incidence of tuberculosis be reliably ascertained. K.R.

Silica removal by an improved magnesia process. H. L. TIGER. *Trans. Amer. Soc. Mech. Engrs.*, **64** [1] 49–63 (1942).—Modern high-pressure boilers with high feed-water make-up requirements frequently demand the reduction of dissolved silica. A new magnesia process for silica removal has been developed, combining flexibility, simplicity, and economy. It can be applied to any type of water at any temperature; it can be carried out in conjunction with the usual precipitation water-softening process; and the increase in operating cost is very small. These results are accomplished by a new method of combining a number of principles embodied in this process. Extensive investigations were conducted to determine the influence of each of various factors on the final result, and data are presented on the effects of (1) the form of magnesium used (whether precipitated ionic Mg or undissolved Mg compound), (2) temperature, (3) sludge-magnesium concentration, and (4) agitation for sludge-water contact. The principles of increasing the Mg^{++} content, when required, by means of a novel sludge-recycling process with a magnesium dissolver are described. A method of using cheap dolomitic lime as a low-cost source of magnesium is also presented. The process lends itself advantageously to a modified Spaulding precipitator type of construction at either low or high temperature, to be followed by suitable treatment with carbonaceous-ion exchangers, when required, for complete removal of residual hardness and reduction of alkalinity to any predetermined figure. Illustrated. F.G.H.

Sources of scientific information. R. S. HUTTON. *Jour. Inst. Civil Engrs.* [London], **17** [4] 349–58 (1942).—Scientific literature serves two purposes: it keeps its readers abreast of current science and acts as a repository of knowledge. An engineering student should become acquainted with his university library and those available in other centers where he is likely to work. The libraries in Great Britain and some books on how to use libraries are mentioned. In making a search on a special problem, there are (1) encyclopedias and books on reference books available on the subject and (2) abstracts of the current literature; no one scientist can read all the periodicals. Many societies, associations, and industrial companies have developed specialist libraries and information bureaus; those in Great Britain are listed by the Assn. of Special Libraries and Information Bureaux (ASLIB). New books are listed by the American Special Libraries Assn. H. details several other sources of information, chiefly applicable to Great Britain. L.R.B.

Standard crane signals. ANON. *Can. Machinery*, **53** [8] 90 (1942).—Six standard signals are illustrated and described. E.D.M.

Testing ceramic materials. OTTO MANFRED. *Keram. Rundschau*, **45** [38] 437 (1937).—As the three large groups of work materials, metals, inorganic and nonmetallic materials, and organic materials, often have the same fields of application, M. suggests that the tests for these materials be standardized along analogous lines. M.V.C.

Thermodynamic properties of vapors. ERICH F. LEIB. *Trans. Amer. Soc. Mech. Engrs.*, **63** [2] 157–76 (1941).—An analytic investigation of the equilibrium of a liquid with its vapor shows how the vapor-pressure curve can be found from the equation of state. Illustrated. F.G.H.

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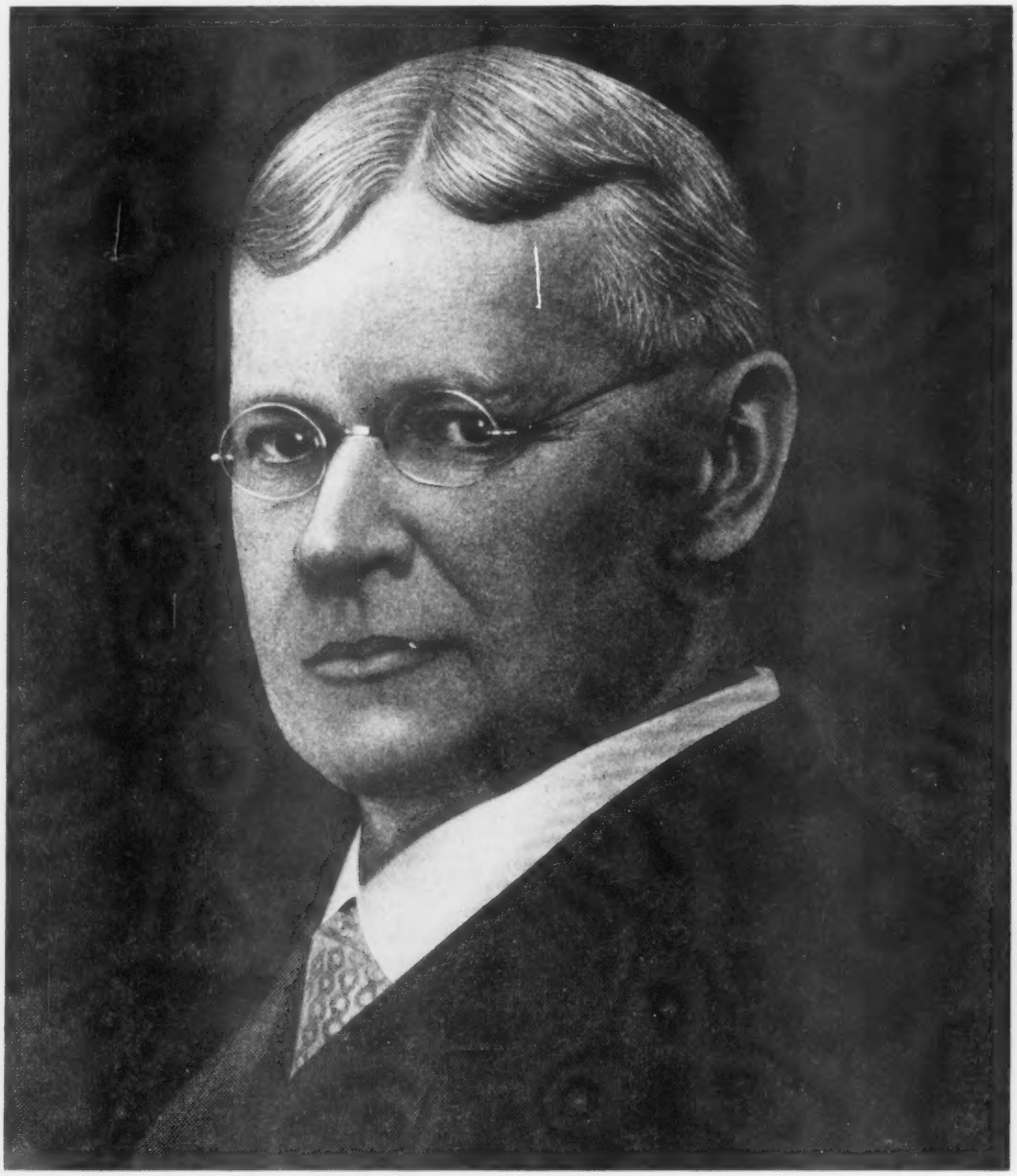

IRVING WIGHTMAN COLBURN

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By William P. Clarke, Toledo, Ohio

Conforming to the request of Ross C. Purdy, General Secretary of The American Ceramic Society, which request was initiated by my good friend, William M. Clark, of the General Electric Company, I have undertaken the task of presenting a biographical sketch and picture of the late Irving Wightman Colburn, the inventor of the continuous flat-drawing window-glass machine that bears his name.

The likeness of the inventor, which accompanies this sketch, shows him at the time when he was engaged in the effort that he set out to accomplish, whereas my acquaintance with him came when he was showing the effects of his many disappointments, and this notwithstanding the fact that success was about to crown his efforts.

Irving Wightman Colburn was born at Fitchburg, Massachusetts, May 16, 1861, and died at Toledo, Ohio, September 4, 1917. In his fifty-six years he encountered numerous obstacles, surmounted many and failed frequently. But he must have been possessed with a will and a determination superior to that possessed by the average man or he would never have accomplished that which he set out to do. The writer, having been identified with the glass industry for almost half a century, and understanding its history, its peculiarities, its problems, and its progress, may more fully appreciate the troubles and the accomplishments of this man than will the reader who has not had these experiences.

Readers of this review may obtain a better insight as to what Irving Wightman Colburn aimed to achieve if they have some knowledge of the method by which window glass was previously made.

Window glass was produced originally by the cylinder process, which required the services of skilled mechanics. The first workman was termed a "gatherer" and it was his job to insert a blowpipe into a pot or tank of molten glass and gather (twist) therefrom sufficient glass to produce a sheet that would be in keeping with the order given to the shop (this order may have called for twenty to fifty pounds of glass). The gatherer manipulated the glass to a ball shape by turning the pipe (with the glass attached) in a wooden block. The pipe and glass were then passed to the next workman, who was termed the "blower." He placed the end of the pipe in his mouth and with the force of his lungs expanded the ball of glass; at the same time, he would swing the glass in a "swing hole" until it became cylindrical in shape and from four to ten feet in length; the size of the cylinder was in keeping with the size of the sheet desired. The diameter of the cylinder would vary from twelve to twenty inches. The pipe with the cylinder attached would then be passed on to the "snapper," who severed the cylinder from the pipe and removed the excess glass at the pipe-end of the cylinder by wrapping a thread of hot glass around the cold cylinder. The cylinder was then "split" lengthwise by running a hot rod on the inside of the cold cylinder, thereby causing it to crack and spread slightly. Then followed the work of the "flattener," who placed the cold cylinder in a heated oven where it remained until it was reheated to a degree that would enable him to spread the cylinder by inserting a rod with a block of wood attached. As the glass became plastic, he would gradually open the cylinder and rub it with the wooden block until the sheet became flat.

Mr. Colburn aimed to eliminate all of the foregoing operations by drawing a sheet of *flat* glass directly from a tank of molten glass. Those closely identified with the window-glass industry had little fear of his plans being perfected, owing to the enormity of the undertaking, but he did succeed in blazing the way to this accomplishment to such a degree that there is now no place in the world where window glass is made by the hand process here so hastily and briefly described.

Mr. Colburn was of English extraction. His father was Henry Joseph Colburn and his mother was Eliza Siner Colburn. They had five sons but no daughters. His early ancestors were identified with the textile industry and were credited with various inventions. His father was manager of a machine shop and the inventor of some wood-working machinery while he resided at Fitchburg, and he maintained a well-equipped mechanical shop in his home where Irving, as a youth, spent most of his leisure time.

Electrical experimentation attracted the attention of the youth while he was still a student in high school. After graduation, he spent a few years working with his father. At the age of twenty-two he established the first agency to sell electric equipment in the city where he was born. In 1891, he organized the Colburn Electrical Company. His business thrived and in four years a new and enlarged plant was built. Then came a disappointment when he needed some additional working capital, a disappointment due primarily to the fact that he was unknown in the financial world. He had made the grave mistake of allowing his products to be marketed under the name of his distributors instead of the name of his own company. This caused his financial ruin and he was forced out of business.

Here it may be related that Mr. Colburn is credited with having installed the first telephone as well as the first electric light in the city of Fitchburg. He also manufactured dynamos and electroplating machinery along with kindred devices that evidently caused his thoughts to run along the channel of inventions in fields other than that of glass, then an industry unknown to him. For this reason his efforts and accomplishments in the glass industry are all the more marvelous, yet his success would never have been what it was had it not been for the great financial and practical assistance rendered by others, as will be shown later.

After his failure in the electrical business he visited his father, who had moved to Toledo in 1890 and had found employment with Baker Brothers, the Woolson Spice Company, and later with the Toledo Glass Company, where he was employed as a designer and mechanic. This visit probably gave Irving W. Colburn an inspiration and new ideas. The late Michael J. Owens had already made his

impression on the glass industry by inventing some devices, such as the tumbler and chimney machines, which revolutionized the methods of work and production. The tumbler machine was installed by the National Glass Company at Rochester to make tumblers and the Dominion Glass Company installed the chimney machine at Montreal to make chimneys.

In 1898 we find Irving W. Colburn in Frankford, Pennsylvania, where he began to develop ideas that were applicable to the glass industry. He attempted to build a machine to make tumblers and chimneys, evidently aiming to compete with or surpass the machine which Michael J. Owens had placed on the market. This experiment cost him $17,000 and ended in failure, so he left Frankford and located at Franklin, Pennsylvania, where he made another start. The financial loss suffered at Frankford proved to be an accomplishment in the way of experience; that is, although his plans failed, he gained some knowledge of the contraction and expansion of both glass and iron, which is peculiar to, as well as essential to, a successful operation in the glass industry—a principle not generally known or fully recognized by many who have spent years and years in the glass industry.

While experimenting with the machine for making tumblers and chimneys, Mr. Colburn visited a paper factory. While watching a paper machine in operation, he conceived the idea of drawing a continuous sheet of flat glass from a tank to produce window glass. This theory was foreign to the views of those familiar with this branch of the trade and assistance was denied to him. Some successful Franklin capitalists who were engaged in the oil business became interested, however, and the experiment was undertaken. Patent papers were granted to him January 7, 1908. Plans were developed and his ideas were tried for several years. During this time, only 4000 boxes of an inferior grade of window glass were placed on the market; this was the only income his financial supporters received for the money they had invested.

Seeking what appeared to be more modern and convenient facilities, which he trusted would aid him in his effort, Mr. Colburn transferred his operations to Reynoldsville, Pennsylvania, where a larger tank formerly used for hand production was secured and remodeled and additional new equipment was installed. Here another attempt was made to manufacture window glass by drawing a sheet of glass directly from a tank of molten glass, and here again unforeseen problems confronted the inventor. After extensive experimentations, out of which came but 7000 boxes of marketable glass, his financial backers lost hope and refused to finance the undertaking further and the plant was closed indefinitely.

This proved to be a terrible blow to the hopes and ambitions of the inventor, for he had unlimited confidence in his plans and was already on the road to success. To realize more fully why he felt so confident one only need read the following quotation from an extensive article appearing in the Scientific American Supplement, No. 1869, dated May 16, 1908:

> Any attempt to draw sheet glass from a melting pot is met with the supreme problem of controlling the width of the sheet as it is pulled . . . . By far the most systematic and painstaking study which has been made of the whole problem we owe to Irving W. Colburn. He has attacked it from every conceivable side, expended large sums in experimenting, built and destroyed machine after machine, and after ten years has at last built the first commercial successful apparatus for drawing sheet glass of any reasonable width and of any desired thickness, surface, and polish. At the Franklin plant, there are no gatherers, blowers, snappers, or flatteners. The cutters and the superintendent are the only skilled men employed, and the cutters some day will give way to automatic devices. With three men and six boys, more glass and better glass is made by the machine than can be made by thirty-nine men with the cylinder process. [NOTE: The cylinder process here referred to was a method invented by John H. Lubbers and was then in operation but it required the aid of skilled workmen.—W.P.C.] At present, the plant is running twenty-four hours a day, three shifts of eight hours each. The six cutters employed cannot keep pace with the output, for which reason more cutting tables are being installed.
>
> The machine here described [Colburn machine] draws a continuous sheet of glass 42 inches in width [although there is no limit to the width] at a linear speed of 48 inches a minute for double strength. Contrast this with the speed of blowing cylinders by the machine [Lubbers] process for glass of medium thickness, and we see how great an advance Mr. Colburn has made in mere rapidity alone. Apart from the successful manner in which the machine operates, the process is remarkable for the quality of its product. The surface of the glass has a beautiful mirror-like fire polish far superior to the blown window glass which we see everyday. Even plate glass has a surface no better. Remarkable, too, is the way in which the spheres in the working chamber can be adjusted to produce glass of any thickness. We have seen specimens of glass made by this machine almost as thin as fine porcelain and other specimens almost as thick as plate glass.

If you happened to be the inventor and found your efforts and accomplishments extolled as were his in the article just quoted, and in a publication of the standing of the Scientific American Supplement, wherein they ran thirteen large cuts of the plant and the machine along with two pages of comments (and this article appeared before he moved from Franklin to Reynoldsville, where he had a more modern plant and better facilities to aid in his development), would you give any thought to the idea that your efforts for the previous ten years would come to naught and that your supporters would desert you and that you would be thrown into bankruptcy within the next four years? That is what happened to Mr. Colburn and his patents, and his drawings and all that went with his plans were sold at a receiver's sale from the steps of the Court House in Pittsburgh on February 6, 1912.

The hopes of Mr. Colburn appeared to be shattered. He had an idea in which he had absolute confidence and to which he had devoted fourteen of the best years of his life. He saw it all placed on the auction block. Worried and greatly depressed he walked the streets of Pittsburgh the night before the sale. His past was a nightmare, his present predicament was terrible, and the future appeared exceedingly dark and doubtful.

At this point, Michael J. Owens enters the picture. After the plant closed at Reynoldsville, Mr. Colburn visited Toledo where he aimed to interest the directors of the Toledo Glass Company. His proposal was rejected. He next appealed to Mr. Owens and discussed the situation with him thoroughly. Out of this discussion, means were found to enable Mr. Colburn to return to Reynoldsville and place the machine in operation so that it could be observed by Mr. Owens. Impressed, Mr. Owens returned

to Toledo and, in turn, finally convinced the directors of the Toledo Glass Company that the machine could be made a success. It was then that the plan to attend the sale at Pittsburgh and purchase the assets was agreed on. The purchase was made for a nominal sum.

The Toledo Glass Company then employed Mr. Colburn as a consultant to Mr. Owens. A new experimental plant was erected on Castle Boulevard in the city of Toledo, and a new machine and tank were constructed with the assistance of fifteen engineers and draftsmen and several other men who had labored with Mr. Owens on his own inventions. Finally, operations were begun on Thanksgiving Day. The machine was started and the glass was raised. After about two hundred feet were drawn troubles developed which were eventually overcome.

After four years of consistent and expensive effort on the part of the new owners, they announced on Thursday, May 19, 1916, that the Libbey-Owens Sheet Glass Company of Toledo had been incorporated as a $6,000,000 institution and that a plant costing $1,200,000 would be erected at Charleston, West Virginia, to produce window glass by the Colburn method. Since then this plant has been greatly enlarged and wider, thicker, and flatter glass has been drawn than was ever predicted by the inventor. The first unit of this permanent plant was placed in operation early in October, 1917.

During the early part of 1916, Mr. Colburn's health became impaired. The Toledo Glass Company arranged for his retirement from active service but retained him as a consultant when called on. They rewarded him generously and he departed for California and Honolulu, where he spent the winter of 1916 with the hope that he might regain his strength and health. In this he was disappointed and he returned to Toledo in May, 1917. Shortly thereafter he expressed a desire to visit the scenes of his birth. Arrangements were made for a motor trip to Fitchburg but when they reached Williamstown, Massachusetts, his condition brought the journey to an end, and he was confined in the Williams Inn for about nine weeks. A hospital car was then engaged and on August 28 the return trip to Toledo was started. On reaching Toledo, he was taken to his home at 111 Prescott Street, where he died September 4, 1917. His remains were laid to rest in Woodlawn Cemetery, while the ideas that were his have formed the steppingstone for the modernization of the window- and plate-glass industries far beyond his fondest dreams.

PRESIDENT'S MESSAGE

UNFINISHED BUSINESS

The brief interim of the holiday season seems to have slipped quickly behind us. The usual happy memories of this season, for most of us, were tempered by the more serious thoughts of the tremendous war job into which we have been precipitated. In spite of our cheery New Year's greetings, we face 1943 with a staggering load of unfinished business from historic 1942. The proper consummation of this struggle will call for unparalleled strength, ingenuity, and sacrifice on the part of every individual and organization in this country.

The American Ceramic Society, like all technical societies, has acquired new responsibilities arising from the demands of modern warfare. The task of carrying out these responsibilities will not be shirked in spite of handicaps resulting from the diversion of the interests and energies of many of us in additional tasks we have assumed to speed the war effort.

Most ceramic products are vital in the production of our arms and the well-being of our forces and civilian population. Our Society fully realizes its part in the efficient production of these products. It is thus our plan to make the next Annual Meeting reflect the very definite purpose our industry occupies in the continuing war program. Appropriately, we have termed this meeting a Ceramic War Production Congress.

It is worth repeating at this time Churchill's recent remarks that in spite of the first glow of success this is not the beginning of the end, but only the end of the beginning. The further marshalling of our productive power, our man power, and eventually our peace power involves the interests of every member of The Society. In each of these objectives the ceramist has a part. Our Ceramic War Production Congress will represent our group efforts in this behalf.

If, as your President, I have any message for the new year, it is to redouble the contribution each of us can make to insure that 1943 will witness the wane of the holocaust which now envelops the world, to the end that we may speedily secure for ourselves in perpetuity the rights and privileges which represent the American way of living.

—Louis J. Trostel, *President*

CERAMIC TECHNOLOGY SHOULD CONTINUE AS FREE ENTERPRISE

Ceramic War Congress at Forty-Fifth Annual Meeting Will Be Important

"Some thirty governmental agencies are devising postwar plans for all segments of our economy. Government 'thinking' in some circles is well illustrated by the recent studies of the National Resources Planning Board on transportation. Plainly, here is an effort to 'condition' the public to the belief that (1) the industry will require vast modernization after the war; and (2) this must be carried out under bureaucratic control and be dependent upon federal financing. We do not subscribe to these assumptions."

"Whether this country will permit the Government to dictate the economic destiny of all industry or whether public and legislative opinion will uphold our time-tried private enterprise depends largely upon the willingness of private business to anticipate its postwar problems and assume the leadership to plan ahead for their solution."*

* Quotations from letter dated December 8 from the Transportation Association of America.

EDUCATIONAL ASPECTS OF CERAMIC ART*

By J. Sheldon Carey

Abstract

From the educational viewpoint, a survey is presented of (1) what has been accomplished in ceramic art in the past in the United States, (2) the contemporary situation, and (3) some suggestions for the future.

I. Introduction

The title of this paper could be expanded in several different ways. Much of the discussion and writing on this subject has hinged on three questions: (1) How can a student's aptitude for a career in ceramic art be recognized and developed? (2) How many years are necessary to prepare the student? (3) How important is this trained artist to the ceramic industry and will he be able to increase the output of the factory?

Much has been done to help answer these questions, but manufacturers and distributors usually end by stating or implying that the character of the product depends on the public—the man in the street. Industry may create new and better styles, but it continues to make only the styles that the public chooses.

It is toward the man in the street that we should direct our educational thought, therefore, if sound design is to make any headway. The man in the street does not need to be an artist, but he must see and appreciate the beauty around him. He must choose to purchase a piece of ceramic ware for its functional and color qualities that will relate to his environment, instead of buying it because of its price reduction. Macy's in New York City admits that at the present time their greatest turnover in ceramics comes through special sales.

Where can this man acquire a good appreciation of the things he buys? How can we interest him in cultivating this important part of everyday living? Although it may be difficult at the present time, the trend of education seems to be toward the development of a curriculum which will not only affect the individual but his parents and the community. Such a curriculum demands the cooperation of these three with the teacher.

We should keep in mind that the boy of today is the man in the street tomorrow.

II. Survey of Past Accomplishments

This question is asked immediately: "Has anything been done in the American educational system to familiarize the individual with the educational value of the plastic medium, clay?" The answer is "Yes."

The first credit should go to the Industrial Arts High School in Trenton, New Jersey, which established a Ceramic Art Department in 1898. The course was laid out (as were several others shortly after in other schools) to train the individual for industry, but because of inability to place the trained students, the attempts were usually short-lived.

In surveying the beginnings of the educational use of ceramics as a means of general art expression rather than as industrial or vocational aid, we discover that this idea did not originate entirely in the wealthy schools, as might be expected. It appeared almost spontaneously through (1) a need, (2) a lack of equipment with which to teach, or (3) through a recognized desire on the part of the children to do something with their hands, as is shown by the following examples.

(1) About twenty years ago at Newport News, Virginia, a supervisor found a group of negro children who had no initiative or interest in their school work. One day, a boy brought to school some clay which he had found in a bank near his home. With the aid of the teacher, the children began to ask questions. How was it used? Was this the same material the Indians used? Could they make pottery, too? They were soon obtaining material from books and visits to a near-by museum. At the end of a year, they had an exhibit of their creations. The parents became interested, money was collected for a kiln, and a business was eventually developed through which the children were able to earn a fair sum of money.

(2) A small village in a desert valley of California grew up around a railroad center, and the children were twelve miles from the nearest school. A rancher's wife consented to be their teacher, but there were no buildings suitable for a school. The Union Pacific railroad gave them an old boxcar, which the parents cleaned out in their spare time. Windows were put in, the walls were painted, an old stove was set up, and boxes and an old table were moved in. They had no equipment or books, however, so they tried to make things in sand. Then one day the children discovered some clay. One of the girls who had lived in Arizona had seen her Indian mother make pottery from clay. The mother was invited to the school to show the children all that she knew about the making of pottery and the building and firing of a kiln. The children wanted to know more, so the teacher obtained some books through a loan library on Indian and other types of pottery.

(3) A teacher created considerable interest in clay work in a rural school in Ontario, Canada. One of her older boys made a potter's wheel out of an old milk separator. They constructed a satisfactory kiln with a large crock and some old brick and used coke for fuel.

(4) In 1908, the small children in a private school in the Middle West wrote stories of how they thought man might have discovered the use of clay. These stories were then read before the group and their plausibility was discussed. At other times, interesting stories about the lives and experiences of ceramists were read to the children as they modeled in clay.

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Each one of these foregoing experiences has gone into building and improving the appreciation of ceramics for the individual. Such methods could be used in any school in every phase of education to give the child some practical and visual experience which is far superior to theory.

III. The Contemporary Situation

At the present time, articles on the use of ceramics in the public schools can be found in almost any art magazine. Yet many of them should not have been written, for they often do more harm than good; for instance, ninety per cent of them suggest the use of show-card colors for decorating and coloring pottery and figures.

The college student today who has not worked with some form of clay at some stage in his school program is rare, but it would be interesting to know how many students still think that glaze is just colored paint. Ninety-two of the 160 junior and senior high schools in New York City teach some form of clay work for its creative value. Of these 92 schools, only 16 have facilities for firing their ware.

It also would be interesting to know how much experience these teachers have had in the medium before attempting to teach it, especially in such a well-developed school system as that of New York. The deficiency, however, is not always the fault of the teacher. Such work is often forced on them, and their superiors think that ceramic art is like mathematics or a language and that all a teacher has to do is to keep a few pages ahead of the student.

It is amusing to read some of the courses of study in ceramic art which have been worked out for grade and secondary schools by Ph.D.'s who have drawn their conclusions by hurriedly reading a few books on the subject.

A portion of the script of a new syllabus which appeared this autumn is cited as an example. It is to be used in the junior and senior high schools of one of the best state school systems in the United States. After reading the whole section on ceramics, it is assumed that the author is an elderly person who has become acquainted with ceramics through an interest in Egyptian and Persian blue glazes. He implies that to become interested in ceramics one should read as much as possible on these subjects. A discussion of the alkaline glaze is predominate throughout the book. The syllabus is divided into three sections, viz., (1) discussion topics, (2) class and creative problems, and (3) required research. In Section (1), with all types or periods of sculpture to choose from, the author states: "Discuss action and movement shown in the work of Gothic sculpture"; in Section (2), "Throw on the wheel *cylindrical* forms, such as a vase or bowl"; and in Section (3), "Make drawings of Greek vases of red clay with decoration in black, white, and red."

A brighter picture is painted when we consider what could be and what is being done in schools that have teachers who have had extensive training in ceramics. Approximately thirty-five of the one hundred and fifty graduates in ceramic art from the New York State College of Ceramics in the last ten years are teachers. In response to an inquiry, they state that generally they are allowed to teach clay work as they please. They have little trouble in proving its value and have been quite successful in obtaining equipment. Yet they often indicate that they have had to educate their superiors before they could teach the children. The writer vividly remembers his own experience in teaching an over-crowded class which met twice a week for forty minutes. Most of the group had tried to create figures, keeping in mind form and the relation of one mass to another. Many of the students had been able to obtain a real and sincere feeling in their work. As usual, this group had its misfits, e.g., Tony, who made a "L'il Abner." After about three months, the first creations were on a shelf drying when the principal walked in, spreading good cheer. As he went admiringly around, all eyes followed. "Aha!" With outstretched hand he flattered Tony's imitation. Three month's teaching had been ruined.

IV. Some Suggestions for the Future

Clay is an inexpensive medium with which a child can create, can train his muscles and mind to coordinate, and can acquire sensitiveness in seeing the things around him. Many a student, for the first time, finds himself on the same level with, or superior to, his classmates who have usually excelled him. He has proved to himself that he can do something. We seldom find an individual who does not enjoy the feel of clay. Harold Rugg sincerely believes there could be no better medium around which to build a whole curriculum, for its possibilities are unlimited. In every branch of learning, ways of stimulating interest and understanding through related ceramic procedures can be found. It may sound trivial to hear such a method of education emphasized at a time when so many other things seem to have assumed primary importance. Our very lives are at stake, it is true, but the more we can conserve and promote the vitality of education now, the greater will be its contribution to a future workable understanding among nations. Art and its media of expression constitute one basis for such an understanding by providing ways of thinking and creating together.

The consolidated schools in the rural sections are also realizing the importance of the plastic medium. They do not understand, however, that the teacher must be competent in the subject if the child is to obtain anything from it. The teacher can do more harm than good by letting some substitute be used in place of clay. Those who are forced into teaching ceramics frantically search for material or methods of procedure. They usually turn to the incompetent material which is found in art magazines and then follow the path of least resistance. Again and again these teachers say: "What can I do next? I gave my pupils clay, and for the first few days they were much interested. But now the imps are beginning to find that it is a beautiful substitute for spit wads. They are sneaking it out of the room and the school is getting to be a mess." Nearly every one of these teachers is going or has gone through some stages of these events which often prove disastrous for teachers, pupils, and even for the thought that clay has any educational qualities.

The marked results displayed by the few qualified teachers, the demand for improving the appreciation of the individual, the need for a medium with which the individual may express himself other than in two dimensions, and the coming need for more universal forms of expression lead the writer to believe that it will not be too long, however, before ceramic art will become a vital part of the educational program. Also, if we see to it that the indi-

vidual is given an opportunity to approach ceramic art from a beneficial and appreciative standpoint, it will not be long before he will demand from the manufacturer different products and a greater variety.

What may happen, however, to such a course of study if it should start in the wrong hands? It has taken years to break down the set rules under which art teachers have struggled to cover requirements set up by a one-time standard or law. Some of those in control of education today believe that an individual has little or no art ability or appreciation unless he can draw a strawberry basket so that it does not have to be labeled.

It takes little imagination to visualize how a Ph.D. might work up a standard for ceramic art teachers to follow or how someone who has dabbled in clay and feels the urge to write might in a flowery manner describe how she has successfully corrupted the minds of her students.

There are members and friends of The American Ceramic Society who could work out a course of study for elementary and secondary schools that would be flexible enough for any creative teacher to follow. Inspiring and creative methods of approach should be suggested. The course of study should be so rigorous that only a competent teacher would dare to attempt it, but it should also be so sound that it would protect such a teacher in his way of thinking about the medium; e.g., a teacher who was being pushed by her principal to do clay work with her children asked if it was a good idea to make a vase out of clay to look like a log cabin?

If this Society would give its support, a competent group could work out a statement of the aims and methods truly harmonious with all that ceramics stands for, and the educators would readily take it up, primarily because they feel there is no such thing as an intangible procedure. To convince them, they must have something to see and feel.

So let us, the members of The American Ceramic Society, present to the educational system a project in appreciation through ceramic art for the elementary and secondary schools. Let us (1) make it flexible, (2) conceive it for the good of all individuals, (3) formulate it to eliminate incompetent teachers, and (4) shape it to truly represent all that ceramics stands for.

We should not *wait too long* before doing something. Let us begin the project with the Latin motto used so often by Charles Fergus Binns: "Confirmatione e Concrematione (Making Permanent by Firing)" and end it with the words of F. A. Parsons: "Let us labor to keep alive in the heart of humanity that spark of celestial fire which blazes the way to sincere and natural living—to refinement, peace, and contentment—the desire to create beautiful things."

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SCULPTURE, ITS PRACTICE AND MALPRACTICE*

By A. Drexler Jacobson

Abstract

The role ceramic sculpture plays in the revival of a wider interest in sculpture generally and the importance of clay sculpture as an art form are considered. The significance of realistic and abstract form is discussed, and historic examples are given to illustrate the distinction. The relative merits of modeling methods are compared, and clay as a medium of permanence is recommended for more serious consideration.

I. Readjustment of American Art Expression

Not least among the activities undergoing readjustment in the fierce struggle for survival today is American art expression. After those fateful days of October, 1929, when economic collapse threatened our nation, a great cultural awakening spread through the land, releasing untouched reservoirs of young native talent. Government-sponsored projects in music, the theatre, painting, sculpture, and crafts swept the country, and art for the masses became a reality. Recently Edward Alden Jewell, art critic for the *New York Times*, pointed out that many large private art collections have been disposed of and that no new ones are replacing them. Art galleries and museums have cooperated with the Government art program with the result that a broader section of the purchasing public has been reached. The combined effort of public and private agencies indicates a trend toward a real democratization of art. When the people of the world return again to peaceful living, art will have found its rightful place in the social scheme.

The topic of this paper, although not a virgin field for discussion, has many facets which will bear examination. In spite of the efforts of public and private institutions to arouse interest in sculpture, it still remains the least popular of all the fine arts. The objections raised that it is expensive to buy and difficult to house do not seem valid. Sculpture does not have the same appeal as the other arts *primarily* because it lacks dynamic substance and is dull and imitative. A searching and fresh approach is needed. A great creative effort has marked the progress in recent years in the fields of music, painting, the dance, and architecture. Sculpture, on the other hand, continues to use the symbolism of the Nineteenth Century.

II. Role of Ceramic Sculpture

It is in the field of ceramic sculpture that a revival of interest in sculpture generally is likely to take place. Clay sculpture, per se, is an important step in that direction; not slip-cast sculpture made from beautifully sandpapered

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plaster models, but simple, honest expressions in clay, direct from the hand of the sculptor, with no assistance other than the fire.

Clay sculpture is one of the most primitive of the folk arts and consequently is the one with the widest possible appeal. In the early stages of all historic periods, clay sculpture has played an essential role, providing us with a clear picture of the customs and rituals of extinct civilizations. This approach may be taking two steps backward to make one forward, but much good can result from it. The untutored taste is extremely naïve but at the same time responsive to dynamic art forms. The very nature of clay, its workability, and its immediate response to the will and hand without the use of tools comes almost as near to being a direct personal expression as speech itself. The hand imparts to clay a character that no mechanical process can achieve. Although mass production requires the use of mechanical processes, that problem can be met simply by producing more ceramic sculptors. The sculptors' materials can be listed in the order of their popularity, as follows: clay, wood, stone, and bronze, and, strangely enough, that is the order of their historical appearance. In the minds of most people, stone and bronze sculpture do not evoke a friendly and personal feeling. They are associated with museums, monuments, and graveyards—with the celebrated and the dead. When preliminary education by the way of clay sculpture has been accomplished, wood, stone, and bronze will take on a new significance.

III. Meanings in Sculpture

The practice of sculpture is the process by which a worker in stone or clay combines material, form, and idea in such a manner that the form dominates the idea. The malpractice of sculpture is the process by which a worker in stone or clay combines material, form, and idea so that the idea dominates the form. Two historic sculptures illustrate this point, namely, (1) a seated figure called "The Thinker," by Rodin, and (2) a colossal seated figure of a Pharaoh, by an unknown Egyptian sculptor. The Rodin figure is a bronze reproduction of clay, a faithful imitation of nature. Its significance as a literary concept is impressive, but sculpturally it has no meaning, i.e., its size or mass does not add to the importance of the idea; its form does not emphasize or serve the concept of a man thinking. The title might have been "Resting" or "Waiting" without in the least being influenced by the form. The Egyptian figure is a carving in stone. It is not a portrait of a king, but a portrait of kingliness, of terrifying and all-powerful authority. Its personal and literary attributes are subordinate to its sculptural and formal meaning. The meaning resides in the monumental structure of the cubic form which dominates and emphasizes the concept of kingship. The more this figure is increased in size, the more awe-inspiring it becomes, and even if it were called "The Thinker" its formal symbolism would enhance the concept. The carvings of Epstein and Ben Schnul belong in this category. There are therefore two kinds of meaning in a piece of sculpture. One is purely formal or sculptural, residing entirely in the character of the form; the other is nonsculptural and has other meanings such as those which reside in the power to evoke religious, patriotic, or sentimental responses. A piece of work may have both meanings or it may have only a nonsculptural meaning. Sculpture which relies entirely on its formal meaning is exemplified by the work of Brancusi. In the Philebus, Socrates said, "Only geometric forms are eternally and absolutely beautiful," i.e., the beauty which resides in the cube, the sphere, and the cylinder, and not that residing in the human or animal form. The latter beauty, according to Socrates, is relative. The nugget of truth inherent in this statement is that there is a universal analogy of form, namely, that all human, animal, and vegetable forms are manifestations of the same architectural principles. The same geometric shapes are common to organic and inorganic life alike. Some notable examples of the use of combined geometric and organic forms are found in Buddhist and Egyptian sculpture. In the former are found variations of cylindrical and ovoid shapes; in the latter are found cubic shapes.

Some modern sculptors believe that the discovery of hollow bronze casting was a major disaster. It made it possible for the clay sculptor to indulge all his whimsies on a monumental scale. All he had to do was make a clay model and the casters did the rest, patine and all. For centuries, sculpture has been nothing more than a reproduction from clay into bronze or, what is even a more heinous crime, the reproduction from clay into stone. Here, in one evil stroke, are brought together those two techniques so utterly antagonistic to each other. "The Hand of God," by Rodin, reproduced in sparkling white marble from a clay model, has all the plasticity of clay; any resemblance to carving and the quality resulting from that technique is destroyed completely. The trend in recent years happily has been toward direct carving and by far the best work belongs to this class.

IV. Modeling Methods

Of the two methods of modeling, namely, the "put-and-take" method (or adding in order to subtract) and the hollow building method, the former has the most pitfalls and in the final result is the most indirect means of arriving at a simple formal statement. One of two things happens—either the form becomes so detailed that it loses all formal value or an attempt is made to stimulate the character of stone carving. Although the latter result is preferable, the work never attains the solidity natural to stone. It always retains a suspicion of that plasticity inherent in clay.

The hollow building method, which offers the widest possibilities, consists of rolling out the clay to proper thickness and, by cutting it into a sort of pattern, the general form of the subject is obtained, to which the surface details are added. This method accomplishes two important things, namely, (1) it provides the geometric shape on which to base the composition and (2) it demands a clear understanding of the desired form in advance. Some striking examples of this technique are found in Peruvian and Central American art.

V. Clay as Medium of Permanence

There is no substance known that can perform the miracles of clay; no material that responds so willingly to the understanding touch of the artist. There is none that offers as many alluring bypaths to the imaginative person. It can rightfully be said that clay is to the sculptor what water color is to the painter. Both media offer fluidity, spontaneity, and playfulness which are absent in the more substantial media of stone or oil paint. Most

contemporary sculptors do not seem to apprehend the true nature of clay; until they do, ceramic sculpture will remain a mediocre, unimaginative triviality. The touch of the true clay sculptor can be seen in the unglazed figures of China, Assyria, Egypt, Central America, and Peru.

If clay is to attain its fullest development as a medium of permanence, it must cease to be used merely to provide models for stone carving and for casting. As substances of distinct and opposite natures, clay and stone demand their own individual techniques.

SEIR HILL
NORWALK, CONNECTICUT

THE COMMUNITY GOES CERAMIC*

BY HENRY E. MARLEY

ABSTRACT

The "why" and "how" of the Ceramic Guild of Cincinnati is presented. The Guild is a cooperative civic enterprise for promoting interest in ceramics through educational lectures and exhibits and by providing ceramic materials and firing facilities at cost.

I. Organization and Aims

For some time, there existed a distinct demand in Cincinnati for an organization which could meet the needs of the ceramic-minded persons in the city. A sizable group of students, graduates of the University, artists, craftsmen, occupational therapists, and hobbyists needed a place where they could have a kiln as well as a place to buy the necessary ceramic materials. The University of Cincinnati, being a municipal institution, could not offer these services. In 1938, with the able assistance of the Public Recreation Commission, a series of meetings was held to see just what could be done to alleviate the situation.

The result was the forming of the Ceramic Guild of Cincinnati,[1] which was incorporated in the State of Ohio as a corporation not for profit.

The aims of this organization are best expressed in the following statement of purpose from the Articles of Incorporation:

"To further and foster interest in the ceramic arts and to that end maintain on a self-sustaining financial basis for use of members of the Guild such equipment and property as may become available to and under the legal control of said corporation; to hold and manage endowment and other funds for the maintenance, replacement, and installation of such equipment and property; to hold and manage endowment funds for the support of similar activities conducted or institutions owned by other corporations not for profit and to accept gifts for itself and for such endowment funds; to afford financial or other aid or assistance to other corporations not for profit as now are or may hereafter be engaged in furthering the purposes above named, or any of them; to establish, maintain, promote, and endow in whole or in part any such corporations not for profit; in the furtherance of the said purposes or any of them, to acquire by deed, devise, bequest, gift, purchase, or otherwise real and personal property, and to hold, invest, reinvest, manage, and dispose of the same.

"No member of the corporation shall ever derive any dividends or profit therefrom. After the organization of the corporation, additional members thereof shall be elected by the Board of Trustees, upon the recommendation of one member. Membership shall cease upon resignation or death."

As soon as the Articles of Incorporation had been adopted, sixteen trustees were elected from among those persons who had attended at least one of the organization meetings. The sixteen receiving the highest number of votes became the Board of Trustees and as such signed the Articles of Incorporation. The trustees, so elected, classified themselves by lot so that the terms of four expired in 1939 and four in each succeeding year. At the annual meeting each year, four new trustees are elected to replace the outgoing members of the Board.

The officers of the Ceramic Guild were elected by the trustees from their own number. Committees were appointed and appropriate By-Laws, necessary for the operation of the Guild, were adopted. Included in these rules are the provisions that (1) anyone interested may be eligible for membership and (2) the dues will vary with the type of membership, as follows: active $1.00 (plus $2.00 initiation fee), associate $3.00, sustaining $10.00, patrons $25.00, and life $100.00.

The total number of members of the Ceramic Guild at the present time is about one hundred.

II. Activities of Members

The first year was, for the most part, spent in organization and in increasing the membership. Before many new members could be enlisted, however, something more tangible than just ambition had to be offered—in other words, a kiln. The search for such equipment ended successfully when Rookwood Pottery offered the Guild the use of a room containing one of its small and unused kilns.

The kiln was put in condition, and the equipment needed for the operation of a salesroom was installed. Red and buff clays were placed on sale; the price was the same for either wet or dry clay. An attendant, usually a volunteer member, was present each Monday afternoon from three until five o'clock to sell clay and to receive and return the ware. The Guild accepted no responsibility whatever for any damage to a piece while in its possession, and all firing charges had to be paid in advance. A Guild member was employed to operate the kiln, and the firing took place on the fifteenth of each month. If there was

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[1] Mary G. Sheerer, "History of the Ceramic Guild of Cincinnati," *Bull. Amer. Ceram. Soc.*, **18** [5] 189–90 (1939).

not enough ware to fill the kiln, the firing automatically carried over to the fifteenth of the following month.

Children up to and including high-school age were encouraged to use the services of the Guild without requiring memberships. All adults who wished to do so, however, were required to become members.

During the second year, a series of colored glazes was placed on sale at the Guild room.

So far, the Ceramic Guild has sold more than two tons of clay and has fired hundreds of pieces of ware made by the Girl Scouts, Boy Scouts, Camp Fire Girls, local school children, Recreation Commission groups, the Baker-Hunt Foundation, professional artists, and private individuals.

During 1941, the Ceramic Guild had to discontinue its use of the room and kiln at Rookwood and new quarters had to be found. A separate building located at the Airport Playfield was rented, therefore, from the Cincinnati Public Recreation Commission for a period of five years. The agreement provided for putting the building in a condition suitable for the Guild's particular needs.

The new Guild headquarters are now ready for occupancy and the materials and equipment have been moved from Rookwood.

The new building had been obtained but the most important tool of the Ceramic Guild, a kiln, still had to be acquired. Through the Board of Education, a suitable gas-fired kiln was located. This was purchased at a reasonable cost, moved to the new building, and the parts necessary for its repair were ordered.

Provisions have been made in the side of the new building for additional space in which a brick kiln large enough to accommodate the work of professional sculptors can be built at a later date.

To finance the purchase and repair of the newly acquired kiln, the Ceramic Guild decided to make and sell ceramic lapel pins. Models were submitted by a special pin committee, and the plaster press molds were made. A call was then sent out to the members to meet at the Ceramic Department of the University for a Pin-Pressing Bee. The next week, another meeting was held, and the clay pieces were trimmed and placed on firing shelves. Successive groups met to aid in the glazing, trimming, and setting and finally in cementing the metal pins on the back.

Owing to the war effort, the supply of metal pins had to be supplemented by badge pins and finally by safety pins.

The program of activities of the Ceramic Guild of Cincinnati was inaugurated in 1939 by an excellent lecture and colored motion picture by Arthur E. Baggs of Ohio State University in cooperation with the Cincinnati Art Museum.

Discussions of technical problems in using clays and glazes and a trip to the art pottery of the Kenton Hills Porcelain Company, Erlanger, Kentucky, were featured in the following year.

In 1940, the activities of the Guild began to expand and included such events as (1) a dinner meeting and an illustrated lecture by Anna Wetherill Olmsted, director of the Syracuse Museum of Fine Arts, who addressed the members and their guests on the general subject of the annual Syracuse ceramic exhibitions (the Columbus group joined the Guild for this meeting); (2) a loan exhibition of important Chinese ceramics from the famous C. T. Loo Collection in New York held at the Cincinnati Art Museum; (3) a dinner meeting and a talk by C. T. Loo, noted authority on Chinese ceramics; and (4) a lecture by J. M. Plumer, well-known archaeologist of the University of Michigan, on some phases of his excavations at the Sung pottery sites.

III. Future Plans

The future plans of the Guild call not only for a continuation of programs similar to those of the past but for many new activities, such as (1) the issuance of brochures outlining certain ceramic fundamentals, (2) provision for a combined workshop and salesroom, owned and operated by the Guild, where members can work in clay and sell their finished pieces (a full-time paid attendant will be in charge), (3) exhibitions of the work of Guild members, (4) the sponsorship of ceramic exhibits and competitions in the public schools, (5) educational exhibits, films, and talks for the clay craftsman, (6) visits to museums, galleries, and special out-of-town exhibits, (7) plant inspection trips to local and nearby ceramic industries, (8) the establishment of a library not only of ceramic books, technical publications, and magazines but of films, especially in color, to be used by the teacher and craftsman for talks and lectures. Toward this end, members have given ceramic books and copies of *The Bulletin* and *Journal of The American Ceramic Society* to the Guild, and colored photographs of important ceramic ware have been made.

The services of the Ceramic Guild of Cincinnati would have been impossible without the assistance and cooperation of such organizations as the Cincinnati Public Recreation Commission, the University of Cincinnati, the Cincinnati Art Museum, the Cincinnati Crafters, Rookwood Pottery, and many others. With the continued support of such civic-minded groups, the Ceramic Guild of Cincinnati hopes to grow not only in internal strength but to increase in many new ways its service to the community.

CERAMIC DEPARTMENT
SCHOOL OF APPLIED ARTS
UNIVERSITY OF CINCINNATI
CINCINNATI, OHIO

We Will Carry On

After Dunkirk Great Britain Was Most Vulnerable
Her Fighting Force and Fighting Equipment Were Nearly Exhausted
But Defiantly She Carried On

We Will Have Postwar Economic Security
If We Determine To Have It

The Forty-Fifth Annual Meeting—War Congress Is Crucial In This Determination

MAKING OF RAKU WARE AND ITS VALUE IN THE TEACHING OF BEGINNER'S POTTERY IN AMERICA*

By Warren Gilbertson

Abstract

The production of Raku ware is described, including the plans of both stationary and portable Raku kilns. With its simple, inexpensive equipment and the direct results obtained, this technique has possibilities of considerable value in teaching beginner's pottery in America. Within its limitations, Raku is a ware of real beauty. Its major use in the Orient is for the tea ceremony.

I. Introduction

During my two years in the Orient studying the traditional craft methods in ceramics, I gave practically all of my attention to the field of stoneware. As a sort of apprentice, I worked daily in the workshop of a famous potter. I took some time from this work, however, to learn about the making of Raku ware, for I had heard surprising descriptions of its production and had become extremely curious about it. Presently, after I had drunk much tea and discussed the idea with friends, and after these friends had drunk much tea with an acquaintance who made Raku ware, and, finally, after they had arranged for me to pay a polite visit to this maker of Raku ware to drink tea with him, the negotiations were made.

Even though I had become thoroughly familiar with the simplicity of the tools and equipment of stoneware potters, I was surprised when I went into the Raku maker's workshop to find that both tools and technique were completely elementary. This was particularly noticeable in the design of the kiln and the method of firing. With all of this simplicity, the ware had much beauty and a good strong, simple character. As I worked in this shop, I became convinced that I had found a technique that would be remarkably adaptable to the teaching of beginner's pottery in America. The kiln seemed especially suitable for this purpose. Structurally it was so simple that anyone with a minimum of ingenuity might build one; the materials of which it was built are easily obtained and inexpensive. But it was the glaze fire in particular that impressed me. Imagine decorating a piece of biscuit ware with underglaze, glazing it, and having the finished piece complete, all in an afternoon! With this simple kiln, the beginner would be able to see and realize that very important element in ceramics, namely, the effect of the fire. One can actually see the glaze mature. The utter simplicity of the process would enable the student to understand the firing as vividly and naturally as the modeling of the clay at the bench, and he would also have the stimulating opportunity of seeing the finished quality of his efforts while the work was still fresh in his mind.

The first day my going to work caused quite a flurry in the household, and I did not accomplish much beyond meeting each member of the family. The children were curious about the foreigner, of course, but because they came into the room only one at a time they were very polite and embarrassed; then there were the customary relatives around who were extremely polite and took a great deal of time. During this interminable session, I drank quarts of tea and consumed incredible quantities of indigestible rice-paste cakes and soybean cakes.

II. The Raku Shop

The Raku maker's home and workshop were in one building, and finally I did get back into the shop to work. It was so completely simple that there is scarcely anything to describe. All the equipment for making Raku ware, besides the benches, consisted of a few wooden decorating wheels, some bamboo modeling tools, and the brushes and colors for decorating.

III. The Raku Ware

The traditional Raku ware is coil built. I admired their sensible custom of keeping the natural soft irregularity of hand-built ware; at its best it was extremely successful, although in some examples the natural irregularity was forced and exaggerated, with unpleasant results. The pottery walls were not too thin, and fine detail and sharp edges were avoided. Because of the softness of the finished ware, this treatment was both practical and most satisfying aesthetically; it was more successful than that used in making the Tonala ware of Mexico, a similar type technically, but often too thin to be practical and with a flimsy feeling to the hand.

I used the local stoneware body to make Raku as well as a low-grade red earthenware body that I obtained from a district where the potters specialized in making dishes for shrine offerings. In spite of the differences in their physical properties, both clays worked well in the Raku firing.

(1) Biscuit Kiln Firing

The biscuit firing was similar to that practiced by the stoneware potters; the object was simply to harden the ware enough for handling in decorating and glazing. The dry ware was placed in the muffle with reasonable concern for having the heaviest pieces at the bottom. Shelves were not used; the ware was placed one piece on top of another. Whole rows of flatware usually were stood on edge, whereas hollow ware was placed face down as a rule.

The main concern in packing the biscuit kiln was economy of space. In the biscuit fire, actual loss was small. After the muffle was filled, it was covered with large pieces of broken bisque to keep the heat in and to protect the ware from the shock of cold air. The lid for the muffle was not used in the bisque firing.

The kiln was fired with sticks of split pine (about 2 ft. long and 2 in. thick), three of which were placed fanwise at the beginning of the firing, so that the ends lying one on top of the other were just inside the mouth of the firebox.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Inc., Cincinnati, Ohio, April 22, 1942 (Art Division). Received April 23, 1942.

As they burned away, the sticks were gradually pushed into the fire. The fire was kept at the mouth of the firebox throughout the firing, as this arrangement apparently produced the most even distribution of heat around the muffle. The bisque firing, which lasted from 4 to 7 hr., was built up gradually, beginning with only three sticks, until, near the end of the firing, the mouth of the firebox was almost entirely filled.

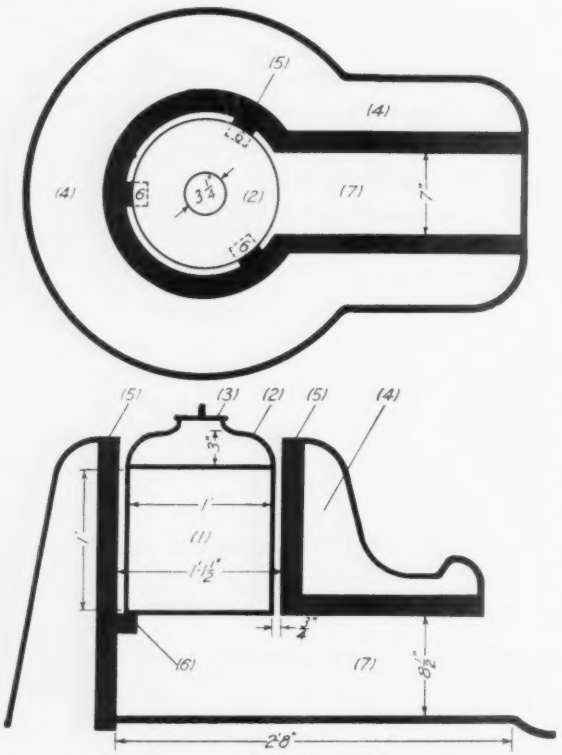

FIG. 1.—PLAN OF STATIONARY RAKU KILN

(1) Fire-clay muffle into which pottery is placed for firing; (2) fire-clay lid for muffle (note spyhole in center of lid); (3) spyhole cover; (4) clay plastered over outside of oven; (5) standard firebrick; (6) firebrick cleats supporting muffle; (7) firebox.

When all the soot accumulated from the earlier stages of the fire had burned off the shards on the top of the muffle, the bisque fire was completed. The coals were then raked out of the firebox, and a sheet of tin was placed over its mouth.

When the ware was cool enough to touch with the bare hands, the bisque kiln was unpacked. The wood-ash dust was removed from each piece by switching it with a bundle of narrow strips of cloth tied to the end of a slender piece of bamboo about 14 in. long. If a piece came out of the bisque kiln partly blackened with soot, it was refired, as the glaze would likely crawl on such a surface.

(2) Decorating

Raku ware was commonly decorated with various treatments of slip on the raw body and an underglaze decoration on the bisque ware.

I saw some fine examples of brushed slip, sgraffito, and, although not common, one or two pieces with trailed slip. The type of earth colors which are sold cheaply in any hardware store offer an inexpensive and rewarding field for color work in slip decoration on Raku. A certain amount of experiment would be necessary, but the ground color would probably have to be mixed with a slip made of buff-firing clay. Since my return to America, I have done a limited amount of work with these ground colors and have found that the results often have much character.

On the bisque ware, we did a considerable amount of decoration with commercial underglaze colors, using them just as they are used in this country.

(3) The Glaze

The batch of the raw glaze used by my teacher is as follows: white lead 85 and flint 15. Raku glazes also often contain a frit.

A vegetable glue was added to the glaze to prevent it from cracking when it was placed in the hot muffle. No exact quantity was measured out, but, like a good cook, the head of the shop simply poured in the quantity he felt was necessary. In America, gum arabic would probably be the appropriate glue to use, but the necessary quantity would have to be determined by experiment.

The glaze was applied by pouring, dipping, or brushing, depending upon which was most convenient. Tradition has accepted the natural effects resulting from uneven application of the glaze. Raku ware is probably fired at about the same temperature as the Tonala ware of Mexico, but the glaze is more thickly applied so that a good substantial quality is obtained and the appearance of shellacked clay is avoided.

(4) Glaze Firing

The refreshing simplicity so noticeable in the traditional methods of the shaping and decorating of Raku ware was especially remarkable in the glaze firing. It is hard to believe that any firing can be done as simply as this Raku glaze fire. The Raku kiln was in a small shed adjoining the workshop; the floor of the shed was dirt, and besides housing a large and a small Raku kiln and, of course, the fuel, it received all the accumulated things from the pottery-making that seemed too valuable to throw away. In America, such a place would have been condemned as a firetrap, but I became fond of this dilapidated shed with its smoke-blackened rafters and enjoyed sitting on a pile of firebrick decorating my ware while I tended the kiln.

In placing the glaze ware for firing, it was put only on the floor of the muffle. The reason for not using shelves will become apparent later. The dome-shaped lid was then placed on the muffle and the spyhole in the lid's center was covered over. It is naturally best to keep the spyhole covered as much as possible during the firing, as opening it too often cools the kiln. Around the top of the kiln and even on the muffle lid, additional pieces of glaze ware were arranged to preheat them for firing.

The glaze firing, which was similar to the bisque firing except that it was faster, was then started. The same split pine was used for fuel and the fire was kept near the mouth of the firebox. As pyrometric cones were not used, I have no accurate idea of the temperature of the glaze fire, but I was told that it was between 700° and 750°C.; this seems to be a reasonable estimate. An hour and a quarter to an hour and a half were required to build the temperature up to the maturing point of the glaze.

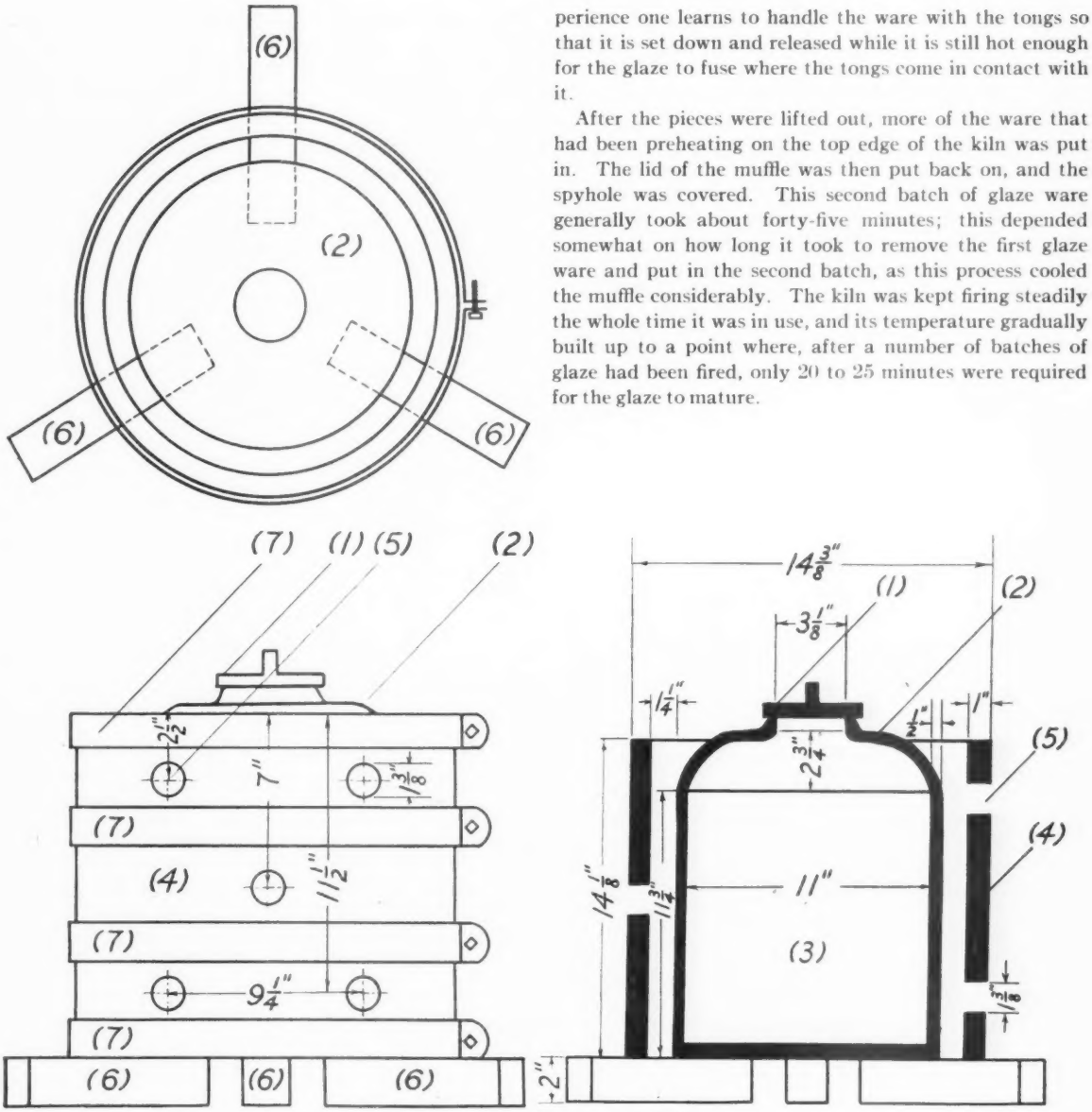

FIG. 2.—PLAN OF PORTABLE RAKU KILN

(1) Spyhole cover; (2) lid of muffle; (3) muffle; (4) outer wall of kiln; (5) vents for supplying air to fuel; (6) firebrick supports; (7) four metal bands.

Occasionally, we would remove the cover of the spyhole with long-handled tongs and look down at the ware. When the glaze had a wet, shiny appearance, it was ready to be removed. Then, with either an iron poker or tongs, we lifted off the dome-shaped lid, an easy operation as the spyhole served as a convenient place for holding it. Then with the tongs we reached down into the muffle and took out the red-hot pottery, one piece at a time, and set it on firebrick placed conveniently nearby for that purpose. The glaze, of course, was in a somewhat fluid state, rather like a thick syrup. Where the tongs touched the glaze, they would leave blemishes unless the piece were quickly placed on a tile and released. I was clumsy when I first did this and made large scars on my ware, but with very little experience one learns to handle the ware with the tongs so that it is set down and released while it is still hot enough for the glaze to fuse where the tongs come in contact with it.

After the pieces were lifted out, more of the ware that had been preheating on the top edge of the kiln was put in. The lid of the muffle was then put back on, and the spyhole was covered. This second batch of glaze ware generally took about forty-five minutes; this depended somewhat on how long it took to remove the first glaze ware and put in the second batch, as this process cooled the muffle considerably. The kiln was kept firing steadily the whole time it was in use, and its temperature gradually built up to a point where, after a number of batches of glaze had been fired, only 20 to 25 minutes were required for the glaze to mature.

This same operation was used with each batch. The glaze was observed through the spyhole; when it was mature, the lid of the muffle was removed, the ware was taken out, and pieces that had been preheating were put in. The lid of the muffle was again put back on. All this was done with the long-handled iron tongs with wooden handle grips. These tongs were over three feet long and were not so heavy that they were clumsy to handle.

If a piece had been taken from the kiln before the glaze was completely mature, it could again be preheated and then refired in the muffle. This could also be done if the scars from the tongs were bad or if the glaze were too thin on the piece and it was desirable to reglaze it.

Sharp edges which sometimes occurred on the blemish

caused by the tongs were also removed with sandpaper or emery stone.

IV. Description of Stationary and Portable Raku Kilns

(1) The Stationary Raku Kiln

As indicated in the key to the plan of the stationary Raku kiln (Fig. 1), the inner walls are of firebrick. Because the kiln is fired at such a low temperature, a low-grade, inexpensive firebrick should be satisfactory. The firebrick are not laid up with mortar, of course, as that material does not stand high temperatures. Fire clay, sold at any building material yard, is used in its place. The fire clay should be used in a soft plastic condition and the brick tapped firmly into place, so that the joints are very thin. As the main part of the kiln is cylindrical, the inside surface would be corrugated if standard firebrick were used. This should be perfectly satisfactory, but the inner walls of the kiln could be plastered with a stiff mixture of half grog, half fire clay, a liberal amount of sodium silicate (if obtainable), and of course just enough water to make the material workable.

Over the outside of the firebrick lining a thick layer of adobe clay mixed with straw is next plastered. At the top rim of the kiln, this layer of clay is about 3 in. thick, and it is progressively thicker down to the base of the kiln. The finished kiln has an appearance similar to our own adobe architecture in the southwestern United States. This thick layer of clay has two functions, namely, (1) it gives the kiln structural strength, and (2) it holds the heat. Naturally, there could be no leakage through these thick clay walls. I have no experience in the plastering of this adobe clay on the kiln, but I have seen the practice followed in the Southwest of America. In plastering a new building, they put on several layers of clay, allowing each layer to dry before applying the next. Considering the properties of the material, this seems to be a logical procedure.

The muffle is exactly like the sagger used in our American potteries, and one could be bought from the nearest large pottery at no great expense. The plan shown in Fig. 1 accurately explains the Raku kiln I used in the Orient; but it may not be possible to obtain a sagger of the exact dimensions shown in the plan. It should therefore be best to obtain the sagger first, before going ahead with building the kiln. With a little common sense, the dimensions could be adjusted to the size of the sagger obtainable.

The greatest, and in fact the only, real difficulty will be encountered with the lid of the muffle. This will have to be made. Ours in the Orient were wheel-thrown with the aid of a template much like a large bowl; then the piece was turned down to the proper thickness with a turning tool. As the lid, like the sagger, must be made of fire clay, and as fire clay is generally not very plastic, a good deal of turning is necessary to get the lid down to a desirable thickness, which should be about $\frac{1}{2}$ in., except at the rim and the edge around the spyhole, both of which should be thicker for structural strength. There is no reason why the lid could not be coil built with the use of a template. If the fire clay is too short to handle easily, enough ball clay should be added to make it workable. The lid of the spyhole should be made of a disk of the same clay, and the handle on the lid should be big enough to be gripped easily with the tongs. These pieces must be fired at a higher temperature than the Raku kiln is capable of; a local pottery, studio potter, or possibly even a brick kiln could manage this satisfactorily.

A sagger wash of half china clay and half flint should be applied to the inside of the muffle. The floor especially should have several coats; but the inside of the lid should not be coated, as it does not need it and flakes of the sagger wash might fall down onto the ware during the firing.

The particular dome shape of the lid is desirable because even after it has cracked into several pieces the segments will fit together and the lid will be usable.

The kiln should be built in a sheltered, dry place.

(2) The Portable Raku Kiln

The portable Raku kiln is fired with sticks of charcoal fed into the space between the muffle and the outer wall. The fuel, which is put in from the top, is kept almost on a level with the top of the muffle. The vents for supplying air to the fuel are spaced at equal intervals around the outer wall of the kiln. Firing time was about the same as that of the stationary Raku kiln except that it was a little slower building up heat when first started. Although this kiln was used for glaze firing only, it might also be satisfactory for bisque firing. With some experiment, this kiln might be adapted to firing with some type of coke or with charcoal briquettes.

The kiln shown in the plan (Fig. 2) is one that I used in the Orient and brought back with me to America. Portable Raku kilns are more commonly about half again as large as this one, with a proportionate scale of dimensions.

All parts of this kiln are made of fire clay. The metal bands around the outer wall of the kiln are necessary as this shell soon develops cracks due to the intense heat on the inside and the cool air on the outside. With the use of the metal bands, however, the outer wall continues to be very serviceable.

V. Conclusion

The opportunity of seeing, in working with the Raku kiln, the effect of the fire on the glaze, the simple effortless control of the fire, and the quick, direct results obtained was stimulating and should help to explain the meaning of pottery to the beginning student, who is not likely to have any conception of this vital aspect of ceramics. And because of the opportunity of getting results so quickly, he realizes the effect of his work in the finished product, while that work is still fresh in his mind.

709 North Damen Street
Chicago, Illinois

BEING A SELFISH MAN
It Is My Intention to Cooperate Fully
With Fellow Ceramists in All Divisions
That I May Acquire Valuable Information
Forty-Fifth Annual Meeting—War Congress, Week of April 18

SALT GLAZING OF CERAMIC WARE*

By H. G. Schurecht

Abstract

This article was prepared to acquaint the ceramic artist with the technique of salt glazing artware. A kiln suitable for the small-scale production of artware is described.

I. Introduction

Although foreign salt-glazed artware is well known in this country, little of this ware is being produced in the United States. The first record of salt glazes was the use of this process in Aachen, Germany, in the 12th century.[1] Some authorities, however, state that England is the birthplace of the salt-glazing process. One of these English authorities gives an interesting anecdote of the discovery. An old English potter was firing a kiln of pipe. The kiln just reached the vitrifying stage when his coal gave out. He broke up some old boxes and barrels to use as fuel. When the pipe was removed, the ware was covered with a glossy coating which was a true salt glaze. The boxes and barrels had contained salt-pork, and the wood had taken up a large amount of the salt brine. From this beginning, the process of glazing in England changed in 1680 from lead glazes to salt glazes on a number of ceramic products.

II. Salt Glazing

With shales, which fire to a red color, the salt glazing is usually done at 2100° to 2200°F., whereas with fire clays and stoneware clays, the ware is usually glazed at 2300° to 2400°F. To obtain a good glaze, the ware is usually first fire-flashed by maintaining a reducing kiln atmosphere previous to salting. The reducing action of the kiln gases converts the ferric iron compounds to the ferrous state so that the clay takes a better glaze.

Salt glazes may be fired in a downdraft kiln, using coal, gas, or oil as fuel. When coal is used, the fires are allowed to burn clear, and the damper is partly closed before salting. A shovelful of common rock salt is then thrown on each fire. The salting is repeated three to five times, and the kiln is cooled slowly. On completion of the salting, the glaze has a gray color because the iron compounds are in the black ferrous condition. The brown color is developed by cooling the ware (with the dampers closed) in an oxidizing kiln atmosphere which converts the black ferrous compounds to the reddish-brown ferric forms.

The quality of the salt glaze is improved by adding water to the salt before it is thrown on the fire. The presence of this water aids in dissociating the salt into sodium oxide and hydrochloric acid and thus permits more efficient salt glazing. Wood is added sometimes with the salt to introduce more water into the kiln at the salt-glazing period and to increase the temperature in the firebox. Oil may also be mixed with salt for the same reasons.

III. Salt-Glazing Kiln

A small downdraft kiln, suitable for salt-glazed artware, has been built at Alfred for small-scale production of this type of ware. This kiln is fired with two air-gas burners, one on each side of the kiln (Fig. 1).

The ware to be fired is set in chamber No. 4. At the finishing temperature, a 1-lb. mixture of 90% of salt and 10% of borax or boric acid dampened with 10% of water is introduced into each of the two salt ports (see (2), Fig. 1), after which the ports are plugged. The salt-glazing mixture drops in front of the highly heated bag wall, and the ware is glazed by volatilization. The damper is closed for one minute after salting, and then the temperature is allowed to rise to its original point before salting again. This process is repeated from three to five times.

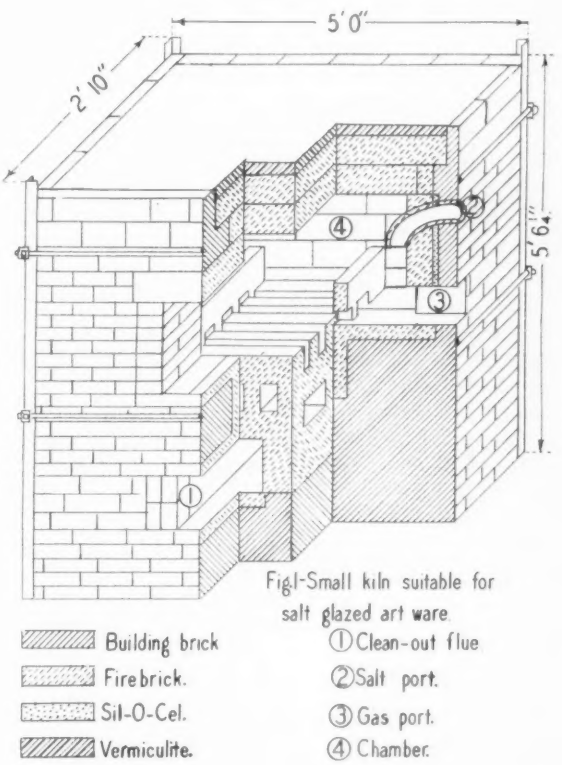

Fig.1-Small kiln suitable for salt glazed art ware.

Open pieces, such as bowls, will become glazed inside. In vases and other deep, narrow-necked shapes, however, the inside of the vase must be painted with a slip glaze, such as Albany slip, because the salt glaze cannot penetrate the interior of such pieces. Salt glazes may be obtained at cones 6 to 8 although cone 1 may be used.

To produce an orange-peel texture glaze, the body should not be blunged and screened but should be used after the run-of-mine clay is ground through a coarse sieve. Blunging and screening the clay tend to produce a smooth salt glaze.

* Presented at the Forty-Fourth Annual Meeting, The American Ceramic Society, Cincinnati, Ohio, April 21, 1942 (Art Division). Received August 25, 1942.

[1] *Tonind. Ztg.*, **13**, 1299, 1717, 1741, 1799, and 1837 (1899).

IV. Composition of Bodies

Certain ceramic bodies will take a salt glaze, whereas others will not, depending largely on the silica content and maturing temperature of the body. Barringer[2] found that bodies which take a good salt glaze generally have compositions corresponding to 1 mol. of alumina to 4.6 to 12.5 mol. of silica. Bodies which are overfired at cone 1 usually cannot be salt glazed with common salt because a higher temperature is required to cause the salt to combine with the body.

Clays containing from 0 to 2% of iron oxide usually take a white-to-tan salt glaze,* brown glazes have an iron oxide content of 3.5 to 4.75%, and mahogany-colored glazes must contain from 4.75 to 8.2% of iron oxide. Ferruginous clays, high in lime, produce greenish-yellow glazes, but a lime content as low as 1% may prevent the clay from taking a bright glaze at low temperatures. High-lime clays can be salt glazed best at high temperatures.

Unlike lime, 1.5% of magnesia improves the ability of the clay to take a salt glaze, but more than 3% of magnesia will dull the glaze. Clays high in magnesia have a tendency to produce crystalline salt glazes at cone 10. A more brilliant glaze, however, may be obtained when from 1 to 5% of titanium oxide occurs in the clay.

If the clay contains soluble calcium or magnesium sulfate, these salts come to the surface and prevent the clay from taking a mahogany-bright glaze but cause it to be dull and greenish-yellow in color. It is, therefore, customary to add 0.1 to 0.3% of barium carbonate which precipitates the soluble salts in the body and thus prevents them from coming to the surface during drying.

V. Slip-Coated Salt-Glazed Ware

Finer grades of salt-glazed ware may be produced by applying engobes[3] of varying compositions to the ware. About 20 to 30% of common salt is often mixed with the slip, which is adjusted to a specific gravity of 1.3 and applied to the ware by dipping or spraying. A large variety of colors and textures may be produced by this process although the firing and glazing will often have to be altered to suit the materials used in the slip. An oxidizing kiln atmosphere is usually necessary, inasmuch as a reducing kiln atmosphere may cause blistering of the glaze if certain coloring oxides are employed.

Parts of ware to be kept unglazed are coated with layers of material rich in alumina or magnesia.[4]

VI. Gray and Colored Salt Glazes

In the production of gray salt glazes,[5] the ware must be fired high enough (2050° to 2100°F.) to produce a gray color in the body. A transparent glaze may then be applied over this body by about six saltings. After salt glazing, the ware should be cooled as rapidly as possible. The clay should be ground fine, preferably through a 20- or 28-mesh sieve, to avoid contamination from iron specks. An oxidizing atmosphere with about 150% of excess air must be maintained throughout the salt-glazing period.

Colored salt glazes may be produced by applying a slip to the ware containing metallic coloring oxides. Metallic coloring chlorides[6] or oxides combined with common salt may also be used in the salt-glazing process. Brown glazes are produced by adding about 2% of manganese oxide or chloride to the salt, and blue glazes may be produced on iron-free bodies by using cobalt chloride. A large variety of colors may be obtained in this manner of varying shades, depending on the amount of chloride or oxide used with the salt.

VII. New Salt-Glazing Mixtures

Considerable progress has been made in developing new salt-glazing mixtures in place of common salt. The writer found that by adding 2% of zinc chloride to common salt much better glazes are produced[7] and a mixture of lithium chloride and sodium chloride will give better glazes than the use of sodium chloride alone.[8] Recent studies[9] at the New York State College of Ceramics have shown that the use of 8 to 12% of borax mixed with 92 to 88% of salt produces a salt glaze at cone 03 on clays which otherwise would not take a salt glaze below cone 1 when only common salt was employed. Glazes may also be produced by using 8 to 10% of boric acid with 92 to 90% of salt. The glazes were smoother and thicker than those produced with borax and the color was darker.

Acknowledgment

The kiln described in this paper was built by Elton S. Gamble and Ralph E. Rhodes as a portion of their thesis work.

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[2] L. E. Barringer, "Relation Between Constitution of Clay and Its Ability to Take Good Salt Glaze," *Trans. Amer. Ceram. Soc.*, **4**, 211–29 (1902).

* Private notes.

[3] (*a*) S. H. Ivery, "Method of Salt Glazing Brick and Other Clay Products," U. S. Pat. 1,735,167, Nov. 12, 1929; *Ceram. Abs.*, **9** [1] 38 (1930).

(*b*) J. O. Everhart, "Production of Salt Glaze by Application of Slip to Ware," *Jour. Amer. Ceram. Soc.*, **13** [6] 399–403 (1930).

[4] Ger. Pat. 540,254 (1929).

[5] C. R. Austin and J. O. Everhart, "Production of Gray Salt-Glazed Ware," *Ceram. Age*, **20** [2] 70–79 (1932); *Ceram. Abs.*, **12** [5] 196 (1933).

[6] Hobart Kraner, "Salt Glazing in Colors," U. S. Pat. 1,728,766, Sept. 17, 1929; *Ceram. Abs.*, **8** [11] 823 (1929).

[7] H. G. Schurecht, "Salt Glazing," U. S. Pat. 1,583,901, May 11, 1926; *Ceram. Abs.*, **5** [7] 216 (1926).

[8] H. G. Schurecht, "Salt Glazing," U. S. Pat. 1,583,902, May 11, 1926; *Ceram. Abs.*, **5** [7] 216 (1926).

[9] (*a*) H. G. Schurecht and K. T. Wood, "Use of Borax and Boric Acid Together with Salt Glazing," *N. Y. State Coll. of Ceramics, Ceram. Expt. Sta. Bull.*, No. 2 (1942); abstracted in *Brick & Clay Record*, **100** [5] 36–38 (1942).

(*b*) H. D. Foster, "Résumé of Technical Studies of Salt Glazing," *Bull. Amer. Ceram. Soc.*, **20** [7] 239–41 (1941).

COOPERATION PAYS CASH DIVIDENDS

This Society spent $1.60 in 1941 and $1.64 in 1942 for each $1.00 paid in as Personal and Corporation membership dues.

ACTIVITIES OF THE SOCIETY

NOMINATIONS OF OFFICERS FOR 1943–1944 THE AMERICAN CERAMIC SOCIETY, INC.*

By circumstances not controllable, the trustees representing the Divisions and Classes are late in announcing their nominations for President, Vice-President, and Treasurer, hence this letter rather than announcement in *The Bulletin* as prescribed in the By-Laws. See *The Bulletin*, Vol. 21, No. 4, page 54, April, 1942.

The Trustees nominate

For *President*,	CECIL E. BALES
For *Vice-President*,	EDWIN H. FRITZ
For *Treasurer*,	C. FORREST TEFFT.

Any twenty-five (25) voting members by signed petition may nominate additional candidates for these offices provided that such nominations reach the General Secretary seventy (70) days before the Annual Meeting or February 7, 1943.

—ROSS C. PURDY,
General Secretary

* Letter sent to all Society members on January 14, 1943.

MATERIALS AND EQUIPMENT DIVISION NOMINATIONS FOR 1943–1944

Chairman: E. M. RUPP, 58 Fallis Rd., Columbus, Ohio.
Vice-Chairman: J. R. KAUFFMAN, Allied Engineering Co., 29 Highland Dr., Milltown, N. J.
Secretary: J. F. DAY, 1901 Dresden Rd., Zanesville, Ohio.
Division Nominations
S. S. COLE, National Lead Co., Titanium Div., Research Lab., South Amboy, N. J.
J. F. MCMAHON, New York State College of Ceramics, Alfred, N. Y.

EDWARD ORTON, JR., FELLOW MEMORIAL LECTURE

Forty-Fifth Annual Meeting—War Congress, Pittsburgh, Pa.

Week of April 18, 1943

Dr. Norman L. Bowen of the Department of Geology, University of Chicago, will deliver this Memorial Lecture Monday forenoon, April 19. His subject will be "Petrology and Silicate Technology."

Abstract of Lecture

Petrology is concerned with the rocks and mineral deposits of the earth's crust. Like all natural sciences it developed through a descriptive stage in which the principal emphasis was upon the collection and correlation of facts. Recently interpretation has been increasingly stressed, and it has been realized that to reach reliable conclusions regarding the origin of earth materials experiment is an indispensable aid. Acting on this conviction, the petrologist has studied the behavior of various earth materials subjected in the laboratory to a wide range of temperatures, pressures, and chemical environment. He has thus been enabled to reach certain conclusions regarding the conditions to which these materials were subjected during the natural processes by which they were formed. Inevitably he discovered a great many facts of service to the mineral technologist. Some of the industrial processes developed by the mineral technologist have, in return, served to supplement the petrologist's laboratory experiments. Some aspects of this mutual service of mineral technology and petrology will be discussed.

A biographical sketch of Dr. Bowen was published in *Bull. Amer. Ceram. Soc.*, **21** [1] 4 (1942).

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list is probably not complete, and we would appreciate information on other members.

WILLIAM C. BELL, Engineering Experiment Station, Ohio State Univ., Columbus, Ohio.
ALBERT E. BRUNT, Metropolitan Paving Brick Co., Minerva, Ohio.
R. B. CAROTHERS, H. C. Spinks Clay Co., Newport, Ky.
GORDON H. CHAMBERS, Foote Mineral Co., Philadelphia, Pa.
HUGH M. CLEVELAND, 27 Nassau Rd., Upper Montclair, N. J.
ALBERT L. CUSICK, JR., Brush Pottery Co., Zanesville, Ohio.
H. E. EBRIGHT, 16708 Clifton Blvd., Lakewood, Ohio.
C. L. FREDERICK, JR., Plibrico Jointless Fire Brick Co., Chicago, Ill.
B. L. GIVENS, Virginia Polytechnic Institute, Blacksburg, Va.
A. E. HUBBARD, 13 Clifford Rd., Sharrow, Sheffield, 11, England.
WILLIAM T. KAY, E. J. Bartells Co., Seattle, Wash.
T. T. LAND, Virginia Polytechnic Institute, Blacksburg, Va.
LAWRENCE W. LITTRELL, Dominion Minerals, Inc., Piney River, Va.
JOHN E. MARTIN, Link-Belt Co., Chicago, Ill.
HENRY D. MCLAREN, Ferro Enamels (Canada), Ltd., Ottawa, Ontario, Canada.
F. F. NEWARK, Iowa State College, Ames, Iowa.
HEROLD N. REED, Tyler-Sales Fixture Co., Willard, Ohio.
A. H. SCHOTTLAND, Standard Bent Glass Co., Butler, Pa.
JAMES N. SMITH, JR., North Carolina State College, Raleigh, N. C.
W. T. TREDENNICK, Stowe-Fuller Refractories Co., Philadelphia, Pa.
BRADFORD S. TUCKER, E. J. Lavino & Co., Philadelphia, Pa.

* Published monthly, beginning with the September, 1942, *Bulletin*.

NEW MEMBERS IN JANUARY

Corporation

CORNING GLASS WORKS, Charleroi Division, Arthur W. Weber (voter), 504 Fifth St., Charleroi, Pa.

Personal

AMARANTE, ARMANDO, Rua da Quitanda no. 82, 7° andar, São Paulo, Brazil.

BATES, CHARLES E., 777 Shady Drive East, Mt. Lebanon, Pittsburgh, Pa.; general superintendent in charge of operations, National Fireproofing Corp.

BISHOP, FREDERIC L., JR., 301 Pershing Dr., New Kensington, Pa.; director of physical research, American Window Glass Co.

*CURTIS, WESLEY E., Box J-3, Alfred, N. Y.; research assistant, New York State College of Ceramics.

ESTY, HAROLD M., JR., Derby, N. Y.; secretary, Buffalo Pottery, Inc.

GLAZE, FRANCIS W., 4100 Gallatin St., Hyattsville, Md.; assistant chief, optical glass plant, National Bureau of Standards.

JACOBS, CHARLES W. F., 135 Linwood Ave., Buffalo, N. Y.; technical director in ceramics, Albright Fine Arts Academy.

LARKIN, CHARLES, II, Eden, N. Y.; vice-president, Buffalo Pottery, Inc.

MCKINSTRY, RICHARD G., 7 Penn St., Connellsville, Pa.; melting and batch supervisor, Anchor Hocking Glass Co.

NOVINSKI, FRANK S., 1282 Sheridan St., Camden, N. J.; assistant slip-house foreman, Camden Pottery Division, Universal Sanitary Mfg. Co.

OBERST, CLAIR R., Industrial Ceramic Products, Inc., 965 W. Fifth Ave., Columbus, Ohio; secretary-treasurer.

PALMER, JOSEPH D., 703 Maple Ave., Niagara Falls, N. Y.; assistant technical supervisor, Carborundum Co.

WALLACE, CURTIS C., 19th and Allegheny Sts., Philadelphia, Pa.; chief chemist, Electric Storage Battery Co.

WEBER, ARTHUR W., 504 Fifth St., Charleroi, Pa.; superintendent, Charleroi Div., Corning Glass Works.

WHITE, JONATHAN S., 1302 Singer Place, Wilkinsburg, Pa.; ceramic engineer, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Student

Iowa State College: WILLIAM A. FAUST.
Virginia Polytechnic Institute: GEORGE R. EUSNER.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

Corporation

Office 1

Personal

J. L. Austin	1	H. W. Hunsicker	1
W. E. Cramer	1	W. K. McAfee	1
E. W. Emrich	1	W. D. Packman	1
R. E. Gould	2	José Rossetti	1
R. A. Heindl	1	R. A. Shipley	1
C. E. Henderson	1	Office	3

Student

P. S. Dear	1	C. M. Dodd	1
		Grand Total	**18**

ROSTER CHANGES FOR JANUARY†

Corporation

KENTUCKY-TENNESSEE CLAY CO., R. C. Meeker (voter), 807 City Savings Bldg., Alliance, Ohio (Mayfield, Ky.)

MAXSON, ELWYN L., 1526 Canada Blvd., Glendale, Calif. (Los Angeles, Calif.)

† Address in parentheses is former address.

MISSISSIPPI GLASS CO., R. D. Humphreys (voter), Main & Angelica Sts., St. Louis, Mo. (New York, N. Y.)

OWENS-ILLINOIS PACIFIC COAST CO., 601 36th Ave., Oakland, Calif. (San Francisco, Calif.)

Personal

BAILEY, R. F., Box 638, Hynes, Calif. (membership formerly in name of W. E. Gardner)

BEINLICH, ALFRED W., House 109, Village 2, Sheffield, Ala. (Wilson Dam, Ala.)

BELL, W. C., Severna Park, Md. (Columbus, Ohio)

CAMPBELL, G. DONALD, Pittsburgh Plate Glass Co., Clarksburg, W. Va. (Tarentum, Pa.)

CLEVELAND, ENSIGN H. M., U.S.S. *Prairie State*, 135th St. and North River, New York, N. Y. (Upper Montclair, N. J.)

CLINE, ROBERT W., 8 Upton Dr., Kensington View, Md. (Silver Spring, Md.)

EMISON, M. HERSHEL, Baron Steuben Hotel, Corning, N. Y. (Unadilla, N. Y.)

GELSTHARP, FREDERICK, 1134 Park St., Tarentum, Pa. (Creighton, Pa.)

GUSTAFSON, DWIGHT F., E 4217 22d, Spokane, Wash. (Leesville, La.)

HAHNER, CLARENCE H., National Bureau of Standards, Washington, D. C. (Woodacres, Md.)

HALL, MORRIS P., 3218 Shadyway Dr., Pittsburgh (10), Pa. (Library, Pa.)

HANSEN, J. E., Ferro Enamel Corp., Forbes Rd., Bedford, Ohio (Cleveland, Ohio)

HOSTETTER, JOHN R., 4544 S. Chelsea Lane, Bethesda, Md. (Washington, D. C.)

HUNTING, EVERETT C., Isolantite, Inc., Belleville, N. J (Plainfield, N. J.)

JACOBS, RICHARD A., 731 Benoni Ave., Fairmont, W. Va. (Bloomfield, N. J.)

KOLSTAD, JOHN H., Allied Engineering Co., 4150 East 56th St., Cleveland, Ohio (Wellsville, Ohio)

KREIDL, NORBERT J., Chemical Laboratories, Bausch & Lomb Optical Co., Rochester, N. Y. (State College, Pa.)

KRUSON, JOSEPH H., Big Savage Refractories Corp., Frostburg, Md. (Mexico, Mo.)

LINDBERG, AUGUST G. R., JR., 7710 S. Seeley Ave., Chicago, Ill. (Ottawa, Ill.)

LOBAUGH, FRANK E., 1111 E. Front St., Plainfield, N. J. (New York, N. Y.)

LYTLE, W. ORLAND, Pittsburgh Plate Glass Co., Creighton, Pa. (Pittsburgh, Pa.)

MAHAFFY, WENDEL A., Owens-Illinois Pacific Coast Co., 601 36th Ave., Oakland, Calif. (San Francisco, Calif.)

MASON, 2D LT. LLOYD W., 53d Armored Engr. Bn., A.P.O. 258, Camp Campbell, Ky. (Fort Jackson, S. C.)

MELOY, CHARLES L., Industrial Y.M.C.A., Bayonne, N. J. (New York, N. Y.)

MYERS, CHARLES V., 516 N. Jefferson St., Kittanning, Pa. (Springfield, Ohio)

POWELL, O. E., Indiana Drain Tile Co., Inc., Brooklyn, Ind. (membership formerly in name of J. M. Powell)

RIEGGER, HAROLD E., Civilian Public Service, Camp 39, Coleville, Calif. (Relay, Md.)

ROLKE, HERBERT J., Sociedade de Engenharia Industrial Ltda., Rua Marconi, 23, 8° andar, São Paulo, Brazil (Rio de Janeiro, Brazil)

SANDERS, CLYDE A., American Colloid Co., 363 W. Superior St., Chicago, Ill. (Jackson, Ohio)

STEWART, JACK, 1105 E. Redondo Blvd., Inglewood, Calif. (Los Angeles, Calif.)

STRAIGHT, CAPT. LEE H., 0-355084, 16th Armored Engineers Bn., A.P.O. 251, c/o Postmaster, New York, N. Y. (Adel, Iowa)

THOMAS, JAMES A., 563 Ninth St., Niagara Falls, N. Y. (Syracuse, N. Y.)

WEIS, J. H., R. D. 8, Finley, Lenoir, N. C. (Spruce Pine, N. C.)

YOUNT, RICHARD V., CWS Development Laboratories, Massachusetts Institute of Technology, Cambridge, Mass. (Evanston, Ill.)

What We Now Have Is an
Integrated Ceramic Technology Society
With Free Enterprise
Of Its
Supporting Members
Without Governmental Bureaucratic Control

Members Invest Personal Energy, Time, and Money
Returns on Which Are
"All for One, One for All"

A Healthy Integration of Free Enterprise
Making Rugged Individuals and Corporations
World Leaders in Ceramic Technology

Here Is a Record of Present Paid Members

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 22, 1937	1713	220	12	523	220	2688
December 19, 1938	1815	222	26	589	220	2872
December 19, 1939	1876	237	27	642	220	3002
December 20, 1940	1995	260	25	574	220	3074
December 21, 1941	2029	257	37	609	220	3152
December 21, 1942	2088	270	15	446	220	3039
January 21, 1943	2079	267	11	444	220	3021

PITTSBURGH SECTION

A meeting of the Pittsburgh Section was held at Mellon Institute, Pittsburgh, Pa., January 12, 1943.

D. L. Hadley, design consultant, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., was the speaker of the evening. In his talk, "Art and the Machine," he discussed (*a*) the foreign influence on American art, (*b*) the influence of the war on American art and crafts, and (*c*) the prefabricated home of tomorrow.

—H. E. SIMPSON, *Secretary*

ADDITIONAL FELLOWS OF SOCIETY OF GLASS TECHNOLOGY

Donald Ellsworth Sharp, assistant research director of the Hartford-Empire Co., Hartford, Conn., and Nelson Woodsworth Taylor, head of the Department of Ceramics, Pennsylvania State College, State College, Pa., have been made Fellows of the Society of Glass Technology in England.

Donald Ellsworth Sharp

Their election increases the list of American Fellows of the Society of Glass Technology to eighteen. Other Americans previously admitted to Fellowship are listed on page 23 of the January, 1943, *Bulletin*.

Taylor Biography*

Nelson Woodsworth Taylor was born April 26, 1899, in Pincher Creek, Alberta, Canada. After attending grade and high school in Manitoba and Saskatchewan, he entered the University of Saskatchewan, where he received the B.S. degree in chemistry in 1918. Following graduation, he served as a Cadet-for-Pilot in the Royal Air Force until the end of the war.

In 1919, he returned to the University of Saskatchewan as lecturer and assistant for one year. The next three years were spent as teaching fellow at the University of California, where, after receiving his Ph.D. degree in 1923, he served as instructor for two years.

In 1925, Dr. Taylor became associated with the University of Minnesota as assistant professor of physical chemistry, the post he held until he was appointed in 1933 to his present position as professor and head of the Pennsylvania State College Department of Ceramics.

While at the University of Minnesota, Dr. Taylor made good use of his summer vacations. In 1926 and 1927, he conducted research projects for the Department of Trade Waste of the City of Cleveland, Ohio, and, in 1928 and 1929, for the Mayo Foundation, Rochester, Minn. In 1930 and 1931, he did research work for the Department of Metallurgical Research at the University of Utah, Salt Lake City, Utah.

Nelson Woodsworth Taylor

In 1929–1930, Dr. Taylor studied in Berlin and Göttingen as a Guggenheim Foundation fellow, and in 1936 he served as a delegate to the International Glass Congress in England.

During his ten years at the Pennsylvania State College, Dr. Taylor has been giving both graduate and undergraduate instruction, and he has carried out cooperative research with industry on problems of refractories, slags, enamels, and glasses.

Society Activities

Dr. Taylor became an active member of The American Ceramic Society in 1933 and a Fellow in 1941. He has served as chairman of the Refractories Division (1938–1939), of the Glass Division (1939–1940), and as a member of the Glass Division Research Committee (1940–1942). He has also been chairman of the Committee on Ceramic

* A biographical sketch of Mr. Sharp was published in the April, 1938, *Bulletin*, pp. 183–84.

Education (1939–1940) and has been serving as president of the Ceramic Educational Council since 1942.

Dr. Taylor is also a member of the American Chemical Society (past-chairman of the Central Pennsylvania Section), American Association for the Advancement of Science (Fellow), Society of Rheology, American Institute of Physics (editor of the *Rheology Bulletin*, 1942 to the present time), Sigma Xi, Phi Lambda Upsilon, and Sigma Gamma Epsilon.

Publications

(1) (With J. H. Hildebrand) "Solubility Relations of Certain Gases," *Jour. Amer. Chem. Soc.*, **45** [3] 682–94 (1923).

(2) "Activities of Zn, Cd, Sn, Pb, and Si in Their Binary Liquid Mixtures," *ibid.*, [12] 2865–90.

(3) (With J. H. Hildebrand and T. R. Hogness) "Solubility": IX, Metallic Solutions," *ibid.*, [12] 2828–36.

(4) (With D. F. Smith) "A Simple Pressure-Measuring Device for Use with Corrosion Gases," *ibid.*, **46** [6] 1393–96 (1924).

(5) (With G. N. Lewis) "Paramagnetism of 'Odd Molecules,'" *Proc. Nat. Acad. Sci.*, **11** [8] 456–67 (1925).

(6) (With S. S. Shaffer) "Effect of Complex-Ion Formation upon the Magnetic Susceptibility of Paramagnetic Salts in Aqueous Solutions," *Jour. Amer. Chem. Soc.*, **48** [4] 843–53 (1926).

(7) "Magnetic Properties of Odd Molecules," *ibid.*, [4] 854–59.

(8) "Physicochemical Theory of Sweet and Bitter Taste Excitation Based on Properties of the Plasma Membrane," *Protoplasma*, **4** [1] 1–17 (1928).

(9) "Solubility of Organic Substances and of Weak Electrolytes in Water," *Internat. Critical Tables*, **4**, 250–53 (1928).

(10) "Acid Penetration into Living Tissues," *Jour. Gen. Physiol.*, **11** [1] 207–19 (1928).

(11) (With R. F. Beard) "Kinetics of Oxidation of Iodide Ion by Acid Dichromate Solutions in the Presence of a Neutral Salt," *Jour. Amer. Chem. Soc.*, **51** [7] 1973–85 (1929).

(12) (With Charles Sheard) "Microscopic and X-Ray Investigations on the Calcification of Tissue," *Jour. Biol. Chem.*, **81** [2] 479–93 (1929).

(13) (With F. H. Rohrman) "Preparation of Large Chrome-Alum Crystals and the Interpretation of Some Etch Figures," *Jour. Chem. Education*, **6**, 473–78 (1929).

(14) (With H. B. Bull) "Study of the Toxic Effect of Certain Cations on the Flotation of Galena," *Jour. Phys. Chem.*, **33** [5] 641–55 (1929).

(15) (With F. R. Farthing and R. Berman) "Quantitative Measurements of the Acid Taste and Their Bearing on the Nature of the Nerve Receptor," *Protoplasma*, **10** [1] 84–97 (1930).

(16) "Nature of the Nerve Receptor for the Acid Taste as Indicated by the Absorption of Organic Acids by Fats and Proteins," *ibid.*, [1] 98–105.

(17) "Crystal Structure of the Compounds Zn_2TiO_4, Zn_2SnO_4, Ni_2SiO_4, and $NiTiO_3$," *Z. phys. Chem., B*, **9** [4] 241–64 (1930).

(18) "Interatomic Forces in Binary Liquid Alloys. Quantitative Determination from Thermodynamic Data," *Jour. Amer. Chem. Soc.*, **53** [6] 2421–23 (1931).

(19) "Activated and Van der Waals Adsorption of Ammonia and Certain Other Gases," *ibid.*, [12] 4458–59.

(20) "X-Ray Camera for Powder Diagrams at Any Temperature," *Rev. Sci. Instruments*, **2** [11] 751–55 (1931).

(21) "On the Improvement of the Dictionary," *Science*, **74** [10] 367–68 (1931).

(22) "Solid Cadmium Amalgams. An X-Ray Proof of the Compound Cd_3Hg," *Jour. Amer. Chem. Soc.*, **54** [7] 2713–20 (1932).

(23) "Reactions Between Solids in the Absence of a Liquid Phase," *Jour. Amer. Ceram. Soc.*, **17** [6] 155–63 (1934).

(24) (With B. S. Ellefson) "Crystal Structures and Expansion Anomalies of MnO, MnS, FeO, and Fe_3O_4 Between 100° and 200°K," *Jour. Chem. Phys.*, **2** [2] 58–64 (1934).

(25) (With H. B. Bull and B. S. Ellefson) "Electrokinetic Potentials and Mineral Flotation," *Jour. Phys. Chem.*, **38** [3] 401–406 (1934).

(26) "Heat-Treatment of Ceramic Materials" (editor), *Penn. State Coll. Mineral Ind. Expt. Sta. Bull.*, No. 14, 108 pp. (1934).

(27) (With F. J. Williams) "Reactions Between Solids in the System CaO–MgO–SiO_2 in the Temperature Range 600° to 1200°C.," *Bull. Geol. Soc. Amer.*, **45** [7] 1121–36 (1935).

(28) "Adherence of Glass to Metals," *Glass Ind.*, **16** [8] 243–46 (1935).

(29) "The System Na_2O–B_2O_3: (With S. S. Cole) I, Preparation of Crystalline B_2O_3 and Some of Its Physical Properties," *Jour. Amer. Ceram. Soc.*, **18** [2] 55–58 (1935); (With S. S. Cole and S. R. Scholes) "III, Optical Properties, X-Ray Patterns, and Melting Points of Anhydrous Sodium Borates," *ibid.*, [3] 79–81; (With S. S. Cole) "IV, Vapor Pressures of Boric Oxide, Sodium Metaborate, and Sodium Diborate Between 1150° and 1400°C.," *ibid.*, [3] 82–85.

(30) (With G. R. Pole) "Kinetics of Solid-Phase Reactions of Certain Carbonates with Mullite, Silica, and Alumina," *ibid.*, [11] 325–37.

(31) "Applications of Potash in the Ceramic Industry," *Amer. Inst. Mining Met. Engrs. Contrib. No. 101*, Class H (Nonmetallics) 6 pp. (1936)

(32) "Introduction to the Symposium on 'The Production of Dense Aggregates,'" *Bull. Amer. Ceram. Soc.*, **16** [1] 7–8 (1937).

(33) (With P. S. Dear) "Elastic and Viscous Properties of Several Soda-Silica Glasses in the Annealing Range of Temperature," *Jour. Amer. Ceram. Soc.*, **20** [9] 296–304 (1937).

(34) (With E. P. McNamara and Jack Sherman) "Study of the Elastico-Viscous Properties of a Soda-Lime-Silica Glass at Temperatures near the 'Transformation Point,'" *Jour. Soc. Glass Tech.*, **21** [83] 61–81 (Feb., 1937); "Reply to 'Criticism' by V. H. Stott," *ibid.*, pp. 450–52.

(35) "Law of Annealing of Glass—Quantitative Treatment and Molecular Interpretation," *Jour. Amer. Ceram. Soc.*, **21** [3] 85–89 (1938).

(36) (With E. C. Henry) "Acid and Base Binding Capacities and Viscosity Relations in Certain Whiteware Clays," *ibid.*, [5] 165–75.

(37) (With B. S. Ellefson) "Surface Properties of Fused Salts and Glasses: I–II," *ibid.*, [6] 193–213.

(38) (With William Rast) "Diffusion of Helium and Hydrogen Through Pyrex-Brand Chemically Resistant Glass," *Jour. Chem. Phys.*, **6**, 612–19 (1938).

(39) "Viscosity and Electrical Resistivity and Their Bearing on the Nature of Glass," *Jour. Amer. Ceram. Soc.*, **22** [1] 1–8 (1939).

(40) "Laboratory Course in Refractories," *Bull. Amer. Ceram. Soc.*, **19** [8] 315–17 (1940).

(41) (With P. L. Smith) "Diffusion of Helium Through Several Glasses," *Jour. Amer. Ceram. Soc.*, **23** [5] 139–46 (1940).

(42) (With Cho-Yuan Lin) "Effect of Various Catalysts on the Conversion of Quartz to Cristobalite and Tridymite at High Temperatures," *ibid.*, **24** [2] 57–63 (1941).

(43) (With R. F. Doran) "Elastic and Viscous Properties of Several Potash-Silica Glasses in the Annealing Range of Temperature," *ibid.*, [3] 103–109.

(44) "Elastic Aftereffects and Dielectric Absorption in Glass," *Jour. Applied Phys.*, **12** [10] 753–58 (1941).

(45) (With N. J. Kreidl) "Use of Low-Melting Model Substances for the Demonstration of Silicate Glass Properties," *Proc. Penn. Acad. Sci.*, **15**, 35–38 (1941).

(46) (With Samuel Zerfoss) "Heat-Treatment of Refractory Materials," *Blast Furnace Steel Plant*, **30** [5] 536–41 (1942).

CERAMIC SCHOOL NOTES

ONLY THOSE CERAMIC STUDENTS PHYSICALLY UNFIT FOR ARMED SERVICES WILL BE AVAILABLE FOR EMPLOYMENT

SUBJECT*: Call to Active Duty—Sophomore (second year), Junior (third year), and Senior (fourth year) students in Engineering.

To: All Deans, Junior Deans, College Secretaries, and Student Counsellors.

(1) Sophomore, Junior, and Senior students in the Enlisted Reserve Corps or inducted before June 30, 1943, who are pursuing approved technical engineering courses, will continue in an inactive status until the end of this academic year and will then be called to active duty.

(2) After completion of their basic military training, selection will be made of those soldiers who are to be given further technical training and who will be detailed for such instruction under the Army Specialized Training Program.

* A memo from C. W. Reeder, Armed Forces Representative, Ohio State University, December 16, 1942.

UNIVERSITY OF ILLINOIS

The Student Branch at the University of Illinois, Urbana, Ill., held its twentieth annual Pig Roast, December 8, 1942.

It was a huge success, judging from the number of favorable reports received. The jesting between the faculty and the seniors was well prepared and gave a lot of good fun. Deciphering the banquet menu which was translated into ceramic terms also provided much enjoyment, even though the cook did not appreciate having her steak called "sintered magnesite."

A talk by Coach H. E. Kenney on "Rough and Tumble Fighting Methods" climaxed the evening's entertainment.

China pigs made by the students of the Ceramic Department with the help of Mr. McDevitt were given as souvenirs to those in attendance.

Members of the Arrangement Committee, or "Firing Crew," for the Pig Roast were Ray Davies, Eugene Lynch, Earl Smith, John Graham, Gordon Johnson, and Payson Shonkwiler.

—PAYSON SHONKWILER, *President*

VIRGINIA POLYTECHNIC INSTITUTE

Since the first of the year, most of the programs of the Student Branch meetings at the Virginia Polytechnic Institute have been taken up by seniors who have given talks on their theses. For the next few months, the Student Branch has planned for speakers, smokers, and moving pictures. A film on the operation of a fire-clay plant at Goose Lake, Ill., will be shown at our next meeting and ought to be of interest to the students.

Newly elected officers of the Student Branch are *President*, CHARLES KREY; *Vice-President*, FRANK WHITTLE; *Secretary-Treasurer*, FRANK FELLOWS; and *Corresponding Secretary*, BENSON ZWEIG.

Keramos at VPI is planning to write letters to all of the ceramic engineering alumni who are either in the armed forces or in industry. In this way, Keramos will be able to keep in touch with its members and graduates.

—BENSON ZWEIG, *Corresponding Secretary*

NECROLOGY

JOHN W. SIBLEY

John W. Sibley, who was prominent in the brick industry for many years before his retirement ten years ago, died November 23 at his home in Birmingham, Ala. He had been in ill health for more than a year.

Born in New Orleans in 1869, Mr. Sibley went to Birmingham fifty-three years ago. He began his career as secretary of the Coaldale Brick & Tile Co. and later developed the manufacture of shale paving brick. In 1905, he founded the Sibley-Menge Press Brick Co., Sibleyville, Ala., and for many years served as treasurer of the old National Brick Manufacturers Association.

FRANK R. VALENTINE

Frank R. Valentine, chairman of the board and former president of M. D. Valentine & Bros. Co., Woodbridge, N. J., died at his home in Toms River, N. J., December 3.

Mr. Valentine was born in Woodbridge, N. J., June 8, 1872, the son of Sarah Adaline Anness and James Rossiter Valentine. He attended the Woodbridge public schools, the Bordentown Military Institute, Bordentown, N. J., and was graduated from the Pingry School, Elizabeth, N. J., in 1891.

He then entered the business of M. D. Valentine & Bros. Company. After the death of his father in 1919, he became president. In December, 1934, he was made chairman of the Board of Directors and retired from active management of the business.

Mr. Valentine was also a trustee of the New Jersey Manufacturers Association, a director of the New Jersey and Long Branch Railroad, and a member of the American Refractories Institute (president for two years), the Ceramic Association of New Jersey, Sons of the American Revolution, Royal Arcanum, and Exempt Fireman's Association of New Jersey.

He had lived in Woodbridge, N. J., all his life until 1935 when he moved to Toms River. In Woodbridge, he had always been interested and active in the social and public affairs of the community.

Mr. Valentine had been a member of The American Ceramic Society since 1932.

ERNEST B. PRENTICE

Ernest B. Prentice, vice-president and secretary of the Massillon Refractories Company, died at his home at Aquadale, five miles west of Massillon, Ohio, on January 5, 1943. His death resulted from a heart attack suffered after he had arranged the Christmas lights on the exterior of his home Christmas Eve. He was sixty-three years old.

Born at Sandusky, Ohio, Mr. Prentice moved to Massillon forty-two years ago and was associated with the Massillon Stone and Fire Brick Company, which later became Corundite Refractories, Inc. With the late William G. Hipp and others, in 1919 he assisted in the founding of the Massillon Refractories Company and served as its vice-president and secretary until the time of his death.

The older members of the refractories industry will remember Mr. Prentice as a pioneer in the development of high-alumina refractories.

At one time, he was associated with a brother as professional photographers. Outdoor and color photography remained a hobby throughout his life.

In 1927, he purchased a tract of swampland which he subsequently developed into a garden spot, dotted with a series of small lakes. Three years ago his home was completed, every detail of which he personally designed. This home is unique from an engineering standpoint down to every minute detail and is a true reflection of the character of its builder.

Ernest B. Prentice

Mr. Prentice was a member of The American Ceramic Society, the Ohio Ceramic Industries Association, and the American Society for Testing Materials.

NOTES AND NEWS

AMERICAN FOUNDRYMEN'S ASSOCIATION RESEARCH FOUNDATION

A greatly expanded program for research and collateral projects of The American Foundrymen's Association has been made possible by their establishment of a Foundation which will seek an initial fund of $1,000,000. Authorization for the move stems from a resolution passed by the A.F.A. board in July, 1942, which called attention to the demonstrated value of extraregular Association activities and cited the need for a more efficient plan than the old system of making individual solicitations of funds for each special project undertaken.

Since adoption of the resolution, a preliminary investigation of all aspects of the Foundation plan has been concluded, and a poll has been taken of representative opinion within the industry concerning the feasibility of a "community chest" method for meeting the problem. The first two or three months of 1943 will be devoted to a continuation of this preparatory work and active campaigning will begin in the early spring.

Income from the Foundation will total an estimated $25,000 to $30,000 based upon present rates and will be allocated annually to cover five-year periods so that continuing projects will be supported without interruption. A feature of the program now being developed is a system of matching grants, whereby the actual funds available each year will be increased materially by cooperation with related associations and interests.

Details will soon be released concerning (1) the scope of the Foundation program, (2) the method of selecting projects for development, and (3) the general plan of supervision of the widespread operations now envisioned.

(1943)

OHIO CERAMIC INDUSTRIES ASSOCIATION

The Ohio Ceramic Industries Association has elected the following officers and members to serve on the Board of Trustees for 1943:

President: H. D. CALLAHAN, U. S. Quarry Tile Co., East Sparta, Ohio.
Vice-President: E. E. HILLYER, Clay City Pipe Co., Uhrichsville, Ohio.
Treasurer: G. R. ROBINSON, Hocking Valley Brick Co., Logan, Ohio.
Secretary: H. E. NOLD, Lord Hall, Ohio State Univ., Columbus, Ohio.
F. H. JOHNSON, Summitville Face Brick Co., Summitville, Ohio (now at War Production Board, Washington, D. C.).
C. E. BATES, National Fireproofing Corp., Pittsburgh, Pa.
F. R. HENRY, Simonds Worden White Co., Dayton, Ohio.
J. R. BEAM, Universal Sanitary Mfg. Co., New Castle, Pa.
J. G. LOY, Porcelain Products, Inc., Findlay, Ohio.
J. LEO CHILD, Hancock Brick & Tile Co., Findlay, Ohio.
C. FORREST TEFFT, The Claycraft Co., Columbus, Ohio.
R. E. BOYCE, Harker Pottery Co., East Liverpool, Ohio.
B. T. BONNOT, The Bonnot Co., Canton, Ohio.
C. E. BALES, Ironton Fire Brick Co., Ironton, Ohio.

EMPIRICAL ENCYCLOPEDIC EDUCATION IS OUTMODED

Inductive Learning

Is "Inference From Particulars By Agreement, Difference, Residue, and Concomitant Variation"

This Is John Stuart Mills' Definition of Logic
It Is Thus That Mineralogists Identify Minerals

Deductive Learning

Is By Inference Based On Encyclopedic Recital Rather Than By Marshaling of Fundamentals

It Is Empirical Rather Than Fundamental
Memorizing Without Reasoning Is Outmoded Deductive Education

It Is Only By Inductive Education That Pace Can Be Kept With Present-Day Industrial Advancements

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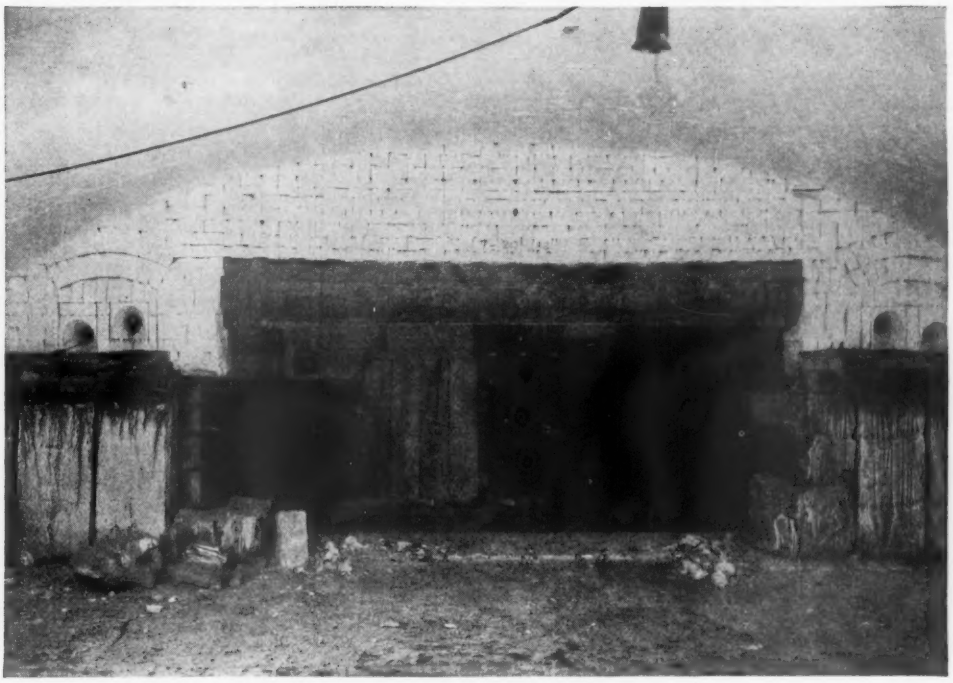
Continuing Ceramic Education By Individuals
Requires Continuing Inductive Thinking
In Terms of Fundamentals
Physics, Chemistry, Geology, Mineralogy, Mathematics
These Are Basic In Ceramic School Curricula
And
In Practice of Ceramic Engineers and Technologists



There's Not Another Like It

NOWHERE else has any engineering organization duplicated this very unique suspended backwall.

It has been in continuous operation for five years on a cross-fire tank furnace pulled on an average of one ton of glass for each 8 square feet of melting area.

NOR is there another combination "just as good" as the Simplex suspended backwall and batch charger.

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FRAZIER-SIMPLEX, INC.
ENGINEERS
436 EAST BEAU STREET • WASHINGTON, PENNA., U.S.A.

Abrasives
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Felker Mfg. Co.
The Hommel, O., Co., Inc.
Norton Co. (*Alundum-Crystolon*)

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
The Hommel, O., Co., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
The Hommel, O., Co., Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co. Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Borax Glass
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
L. H. Butcher Co.
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.

Clay (Bentonite)
Foote Mineral Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Thomas Alabama Kaolin Co.
The Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical, Porcelain)
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Clay (Enamel)
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Clay (Fire)
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.
Thomas Alabama Kaolin Co.

Clay (German Vallendar)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemical Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

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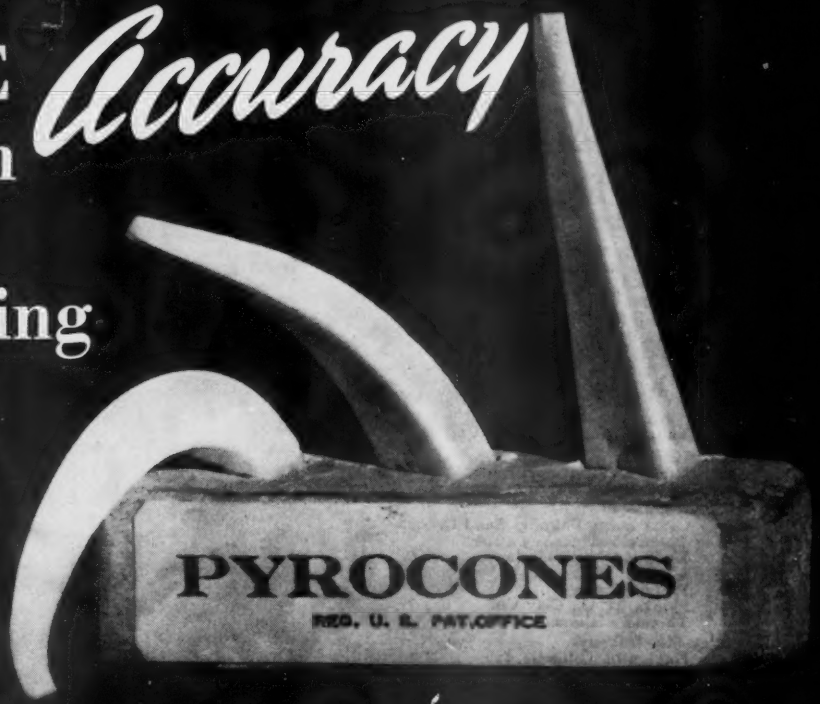
Pyrometric cones, composed of ceramic material, react to time and temperature conditions necessary to the proper maturing of ceramic wares. These small triangular pyramids are designed so that members of a series bend at predetermined temperatures.



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FEW mixing problems are as exacting as that presented in the manufacture of pyrometric cones. Ability of individual cones made from a given batch to indicate temperature within exceedingly close limits is dependent upon uniformity of mix in the cone body.

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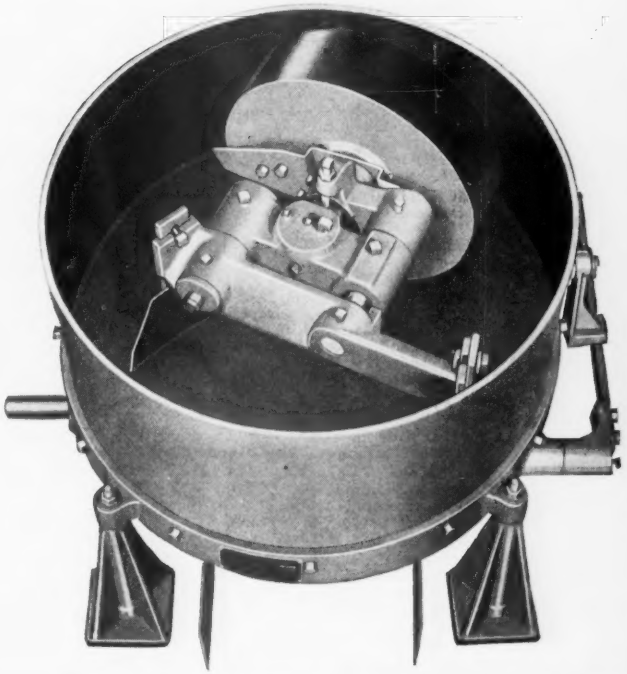

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NATIONAL ENGINEERING COMPANY

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Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

Clay Miners
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Great Lakes Foundry Sand Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel, O., Co., Inc.

Cobalt Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decorating Supplies
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Firing Control System
Forester Firing System

Flint
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control, Stokers
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradiant*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
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Glaze Spar
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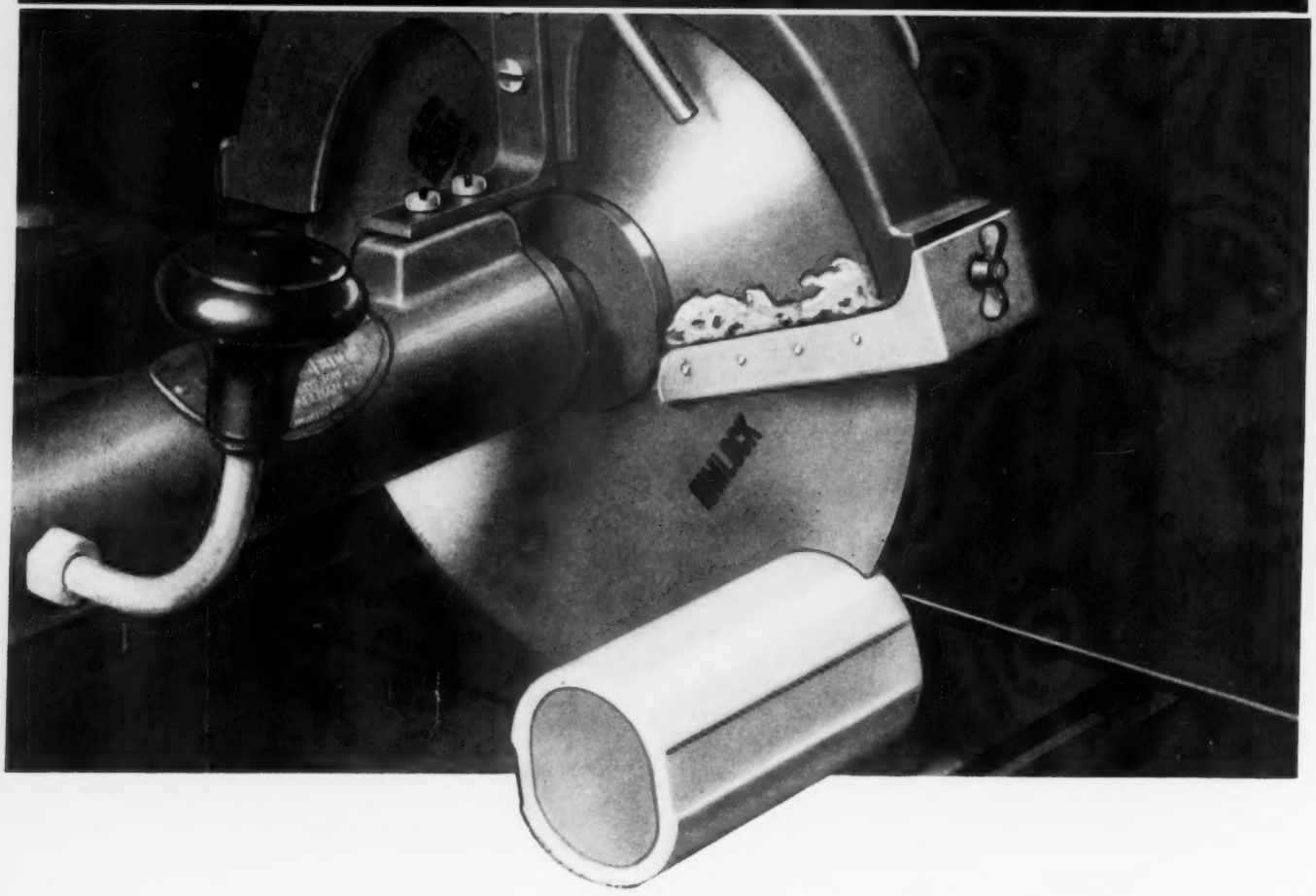

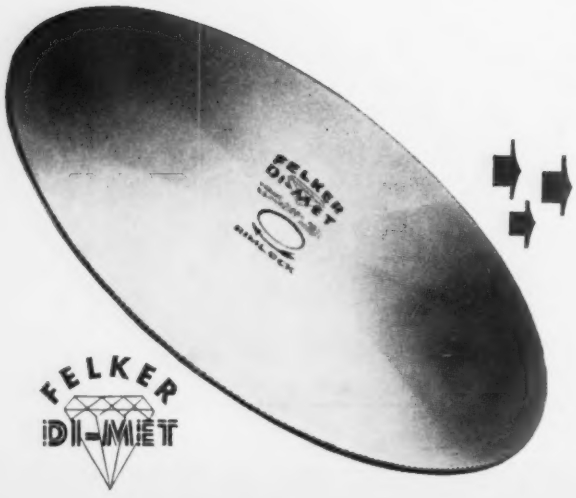

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Sorry. But no more Tin Oxide, Sodium Antimonate or Oxide of Antimony will be available until after the war. ☆ In the meantime, keep in mind, for the future, this symbol of opacifiers which maintain a high standard of purity, uniformity and ability to impart a brilliant, even finish.

METAL & THERMIT CORPORATION
Ceramic Division

120 Broadway, New York